JANUARY 1965 35 CENTS

Popular Science

Monthly

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SEE PAGE 68

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The 1965 Ford rides quieter than a Rolls-Royce!

The world's leading acoustical experts, Bolt, Beranek and Newman, Inc., made the tests. The authoritative U.S. Auto Club certified the results: at 20 mph . . . at 40 mph . . . at 60 mph.

We knew our 1965 Fords were quiet. So did automotive experts who previewed them. In fact, so many automotive editors mentioned Ford quietness, we wondered if a quieter car existed. To find out, we took on Rolls-Royce, the best built, most luxurious car we could think of.

We called in Bolt, Beranek and Newman, Inc., of Cambridge, Mass., famed acoustical consultants to government and industry. We bought two brand-new Rolls-Royce Silver Cloud III's and we tested them against our own new Fords at 20 miles per hour, at 40, and at 60. All cars were tuned to manufacturer's specifications.

One of the new $16,655 Rolls-Royce Silver Cloud III sedans tested.

Our 1965 Fords proved quieter than the Rolls-Royces. USAC certified the results.

Sound is measured in decibels. Normal human speech is about 60 decibels. At forty miles per hour, a '65 Ford is 5.5 decibels quieter than a Rolls-Royce. At 60 miles per hour, the Ford is 2.8 decibels quieter. This is a slight difference, to be sure . . . but amazing when you consider that the Rolls is a hand-built, bench-tuned, $16,655 automobile—and the Ford is built on an assembly line to sell for many thousands less.

Of course, we aren't claiming you'll get a Rolls-Royce for the price of a Ford. The differences are many and obvious. But what you will get in our '65 Ford is an exceptionally smooth ride that comes from a new suspension, new frame, and a new body mounted on the frame at computer-determined places where there is a minimum of vibration. You get a car that rides, as we have proved, quieter than a Rolls-Royce. And in this 1965 Ford you will get solid quality quite unlike anything you have ever known in our price range.

Drive the quiet new Ford before you buy any new car this year.

SOUND LEVEL (All readings in decibels)

MPH	FORD	ROLLS ROYCE	FORD QUIETER BY
20 mph	67.4	72.3	4.9
40 mph	75.9	81.4	5.5
60 mph	82.6	85.4	2.8

TEST CONDITIONS: Dry, level, moderately smooth concrete divided highway; light, quartering wind. All cars operated at steady 20-, 40- and 60-mph speeds with all windows and vents closed. CARS TESTED: Two Rolls-Royce Silver Cloud III sedans, V-8 with automatic transmission, list price in New York $16,655 each. Three 1965 Fords, each with 289-cubic-inch V-8 engine and Cruise-O-Matic: Galaxie 500 LTD, Galaxie 500/XL and Galaxie 500 4-Door Sedan.

Certified by UNITED STATES AUTO CLUB

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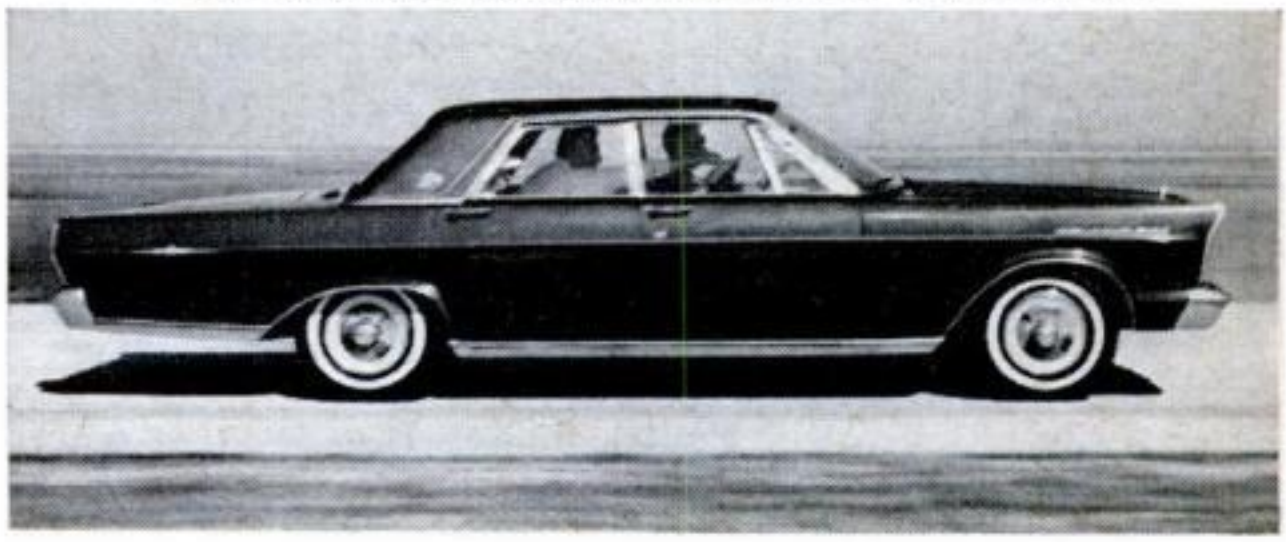
Total Performance 1965 Ford Galaxie 500 LTD 4-Door Hardtop



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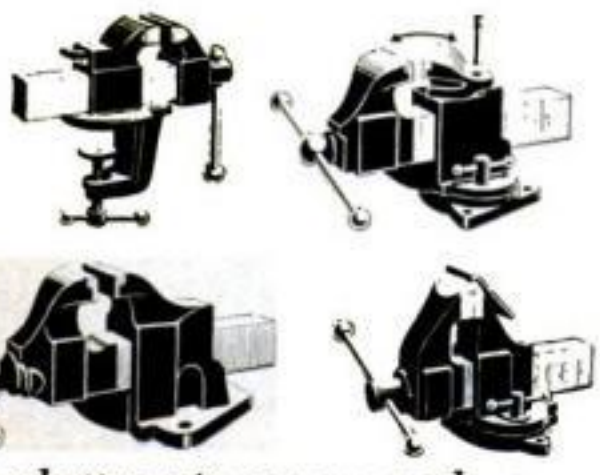

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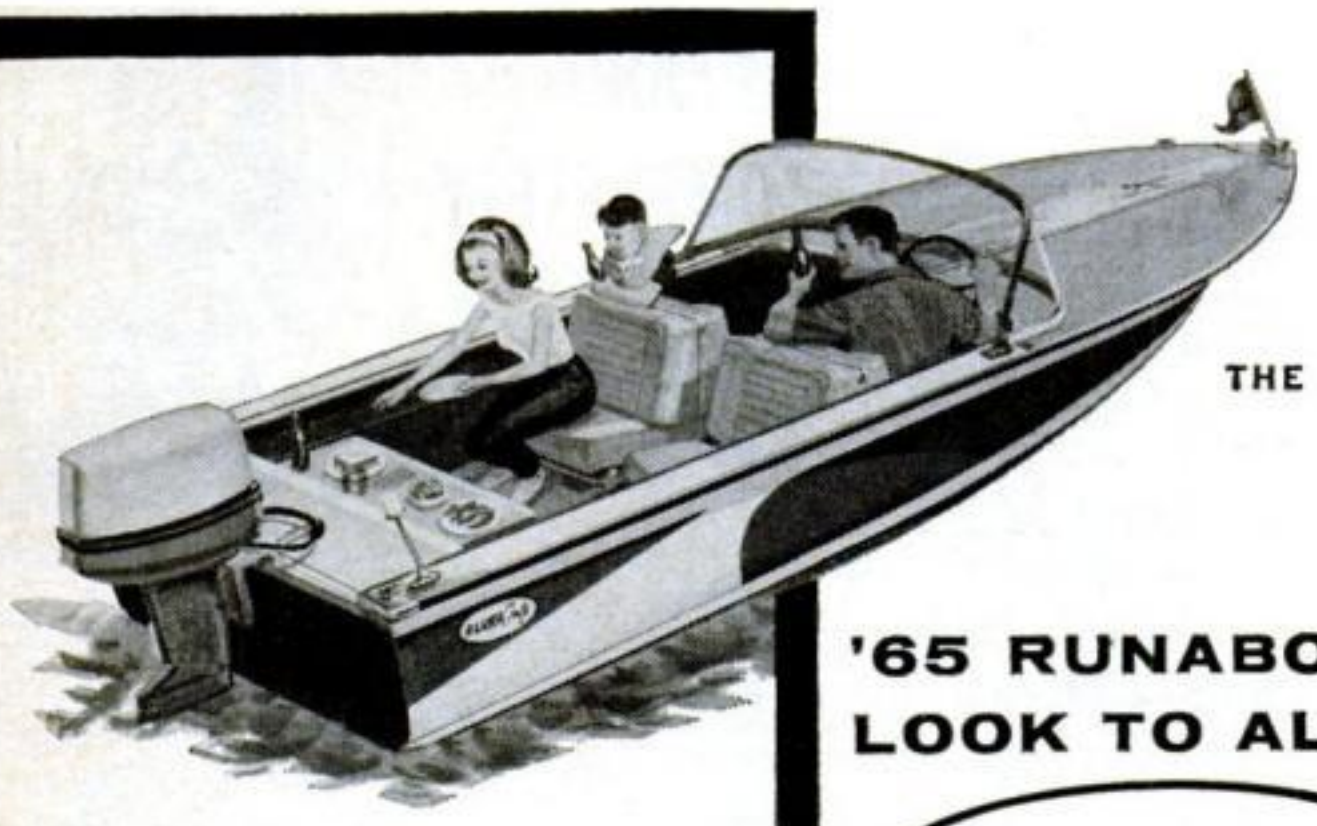

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PS readers talk back

Laser or Maser?

I enjoyed your article on the construction of a laser [Nov.], but was horrified to notice that I was credited with being "co-inventor (with Dr. C. H. Townes) of the maser—a microwave amplifier that led directly to the laser's discovery." I somehow failed to notice this when I read the manuscript. I did not have anything to do with the (microwave) maser. My work was concerned entirely with extending the maser principle to optical wavelengths, to produce what is now known as a laser.

PROF. ARTHUR L. SCHAWLOW, Stanford, Calif.

. . . I first viewed the laser article as a challenge in construction and application. It was only upon closer examination that I became disillusioned.

After spending about $150 and untold man-hours on construction, how would I reply to the embarrassing question, "What does it do?" The

answer that "it will burst a balloon (other than red) at two feet" places the project in the realm of the absurd.

Or is it simply an expensive toy?

TED ROSENBERG, NYC.

Thousands of scientists are asking each other what the laser beam can do, and none of them are embarrassed. Why should you be?

Double Trouble

Doubling the power (torque) on a socket wrench by a planetary arrangement ["I'd Like to See Them Make," Oct.] reminds me that some years back I had the same idea with a screwdriver in mind. After a couple of days, it came to me that you just can't beat the law about every force having an equal and opposite force.

A socket wrench with a planetary gear case would have to have a handle on the gear case and you'd have to pull as hard on that handle as you did on the other one. This would double torque, but you could do that without gears. All you need is two handles on the wrench.

PAUL B. SWEGER, Rockford, Ill.

For Lack of a Nail . . .

"What to Do with a Bright Idea" [Oct.] tells a fine story for the wealthy, but not for those who do not have it made. Many people can apply for their own patents (making their own sketches) at a cost of only $30, but then the pitfalls start. Patent brokers work on a percentage basis, but you have to pay in advance (about $150) before they do anything —and they get commission on top of that. I have three patents applied for, but I can't move because I don't have the money for broker's fees.

D. E. PALMER, Sarasota, Fla.

Two Strings to His Bow

After graduating from Lincoln Technical Institute, I successfully turned an ancient steam system into a seven-zone baseboard hot-water plant. The course isn't easy; but the hardest thing about it was turning down some of the jobs they kept offering me!

R. L. BETTS, D.D.S., Rockaway, N.J.

For Colonial Clockmakers

You can tell Mr. Vitelli ["PS Readers Talk Back," Oct.] that he can probably get plans for a wooden clock movement from R. D. Thomas, 1412 Drumcliffe Road, Winston-Salem, N.C.

W. J. STANTON, Norfolk, Va.

They All Go Boom!

Your statement that at a construction site ["How to Be a Sidewalk Superintendent," Oct.] only the red dynamite-size sticks are dangerous is untrue. In fact, I've never seen a red stick of explosive—except a firecracker.

I have a sample board of various makes, and their colors range from cream through yellow to brown.

FRANCIS A. WALSH, Acton, Mass.

One and ONLY

You have occasionally located antique-car parts for collectors and I wonder if you can help with my problem. Has anybody ever heard of an Only? I have one in desperate need of repairs and because few people have heard of the car I have been unable to locate any in-

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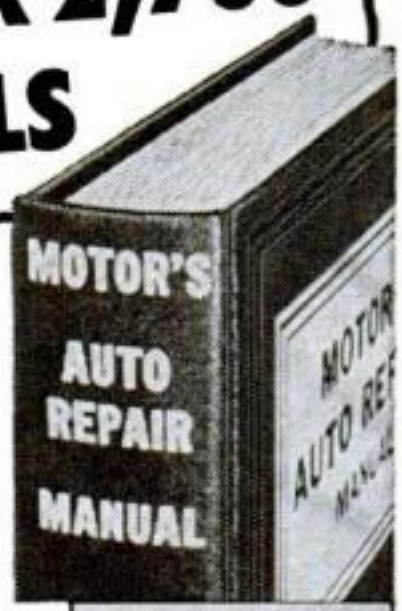

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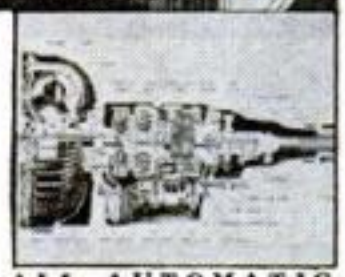

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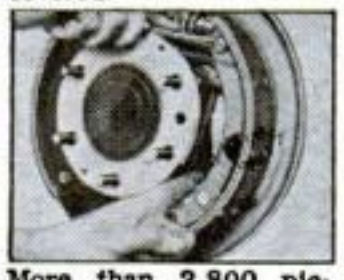

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formation about it. Parts, manuals, blueprints, would be greatly appreciated.

KENNETH DICHFIELD, Richmond Hill, N.Y.

. . . Can any of your readers tell me whether a gasoline automobile patented by F. A. Huntington of San Francisco ever was built?

MURRAY FAHNESTOCK, Pittsburgh.

Water, Water Everywhere

I need help—immediately. From "Stupid Questions About What You Eat" [Nov.], I took one bit of advice to heart: "Don't throw away the water in which you boil the vegetables. It holds up to 50 percent of the minerals."

I've been saving the mineral-enriched water in a giant cask in the kitchen. I planned to sell it to a chemical firm (which could reclaim the minerals) or to donate it to some underfed (and preferably arid) country.

I have found no way to carry out my ideas. Every day, as we prepare more vegetables, the

sides of the cask bulge and creak. Soon, it will give way, flooding my home. My family is in danger of a mineral-rich deluge. Help!

ROBERT P. GREEN, Parma, Ohio.

Throw in a side of beef and some barley—and soup's on!

Poof! And It's Gone?

I've just built your portable auto analyzer [June] that uses a unijunction transistor as an audio continuity/capacitor checker—an ingenious design. With it, an auto mechanic can use his ears (often quite sensitive) as well as his eyes for troubleshooting

People with little electrical experience who build the analyzer should be cautioned that its case is *not* isolated from the circuits and thus should not, in general, be allowed to contact any grounded metal of a car. Accidentally ground the case while using one of the ammeter ranges, and not only the meter movement, but very likely also the shunt in use, would be vaporized!

Wouldn't it be preferable to insulate the various "black" jacks, at the expense of additional wiring and a little care to avoid introducing errors in the shunt circuits?

T. F. C. MUCHMORE, Washington, D.C.

Yes; otherwise, when you're using the dual-range ammeters, the case should never be in contact with the body of the car.

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'Say, Smokey–'

A clinic on cars by America's most famous mechanic

EACH month in POPULAR SCIENCE Smokey Yunick will answer questions on automobiles–family cars, high-performance jobs, hot rods, and racing cars–selected from those sent in by readers. Got a problem? Ask Smokey about it. Address at end of column.

"What could cause the Safety Sentinel in my Oldsmobile to make my speedometer so inaccurate above the speed that I set it?"—Ollie Murphy, Rochester, N.Y.

The Safety Sentinel is controlled by the tension of a spring. Above the set speed, the spring drags on the speedometer hand, causing it to read several miles too low. There is nothing that I–or any mechanic I know–could do to correct this without throwing the whole instrument off.

"While removing spark plugs from my '62 Buick V-8, my serviceman stripped the threads in two holes, so helicoils had to be installed. He claims this is a common occurrence in aluminum-head engines. Whose responsibility is this—the manufacturer's, the serviceman's, or mine?"—D. W. Vedder, San Diego, Calif.

Well, somebody goofed, but who? Somewhere along the line, but not at the factory, somebody replaced plugs without coating the threads with antiseize compound. This chemical is always necessary with aluminum heads and steel plugs. To find the culprit, look for the man who put in the two guilty plugs before those last ones.

"I would like to buy a Corvair, but friends who own them tell me the valves usually burn out by 45,000 miles. Is this the car or the driver? Can valve life be prolonged by keeping the engine 'wound up'? What is the best r.p.m. to maintain with a four-speed box?"—Don A. Bahr, St. Louis.

I doubt that you would have any unusual valve trouble with a Corvair. Valves are injured by excessive heat, not by r.p.m. With a four-speed box, the engine will run well at any speed that doesn't cause it to labor.

"Do you think stock cars will go any faster at Daytona in the future, or have they reached their limit?"—A. Smithers, Santa Monica, Calif.

They'll go faster, but don't look for any great jumps in top speeds. As chassis and body design are improved, top speeds will tend to increase five to six m.p.h. each year, even with engines of present horsepowers. And right now, a 450-cu.-in. engine is in sight on some drawing boards–if it's within the rules when it actually becomes hardware.

"My '64 Olds F-85 Custom four-door

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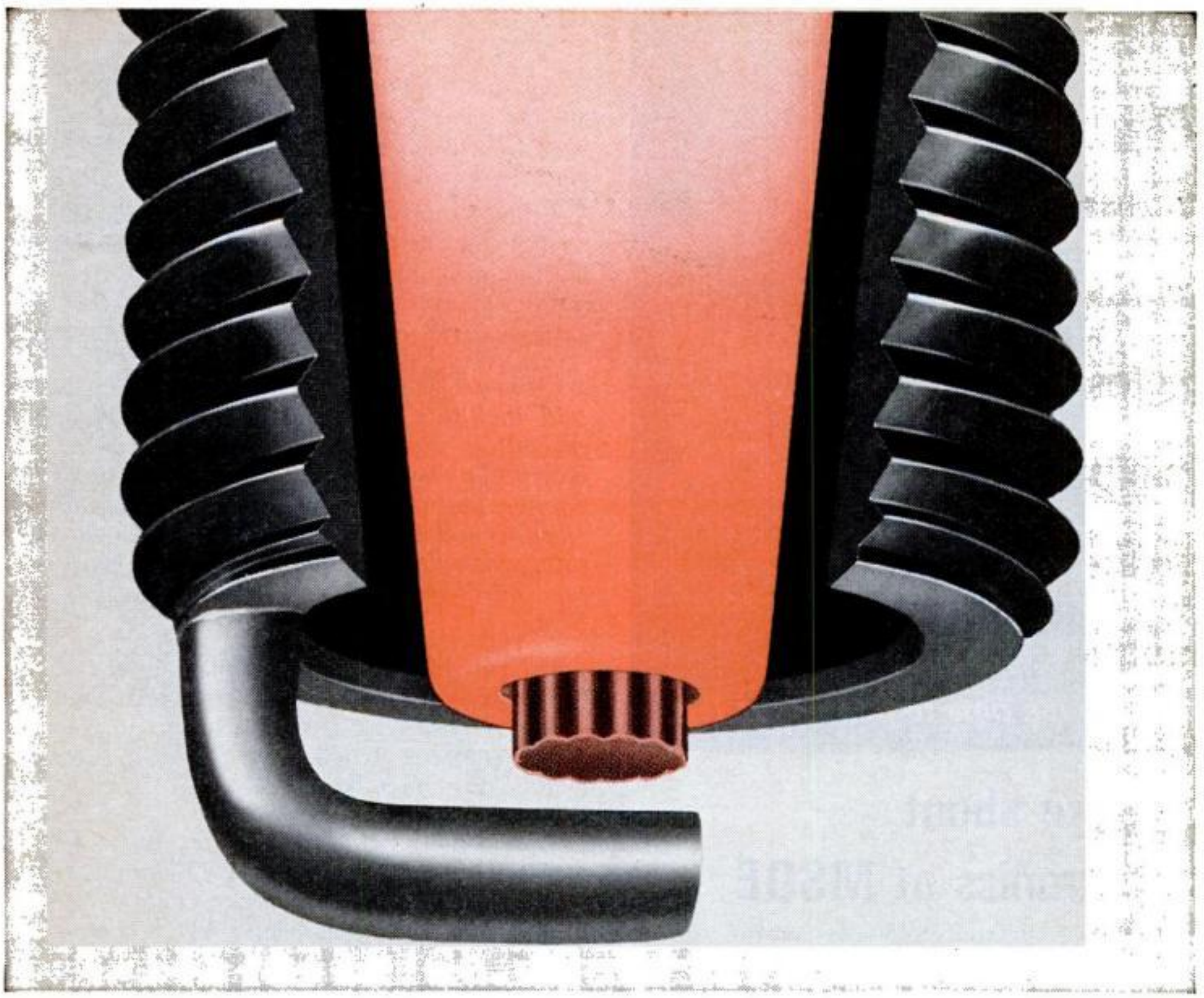

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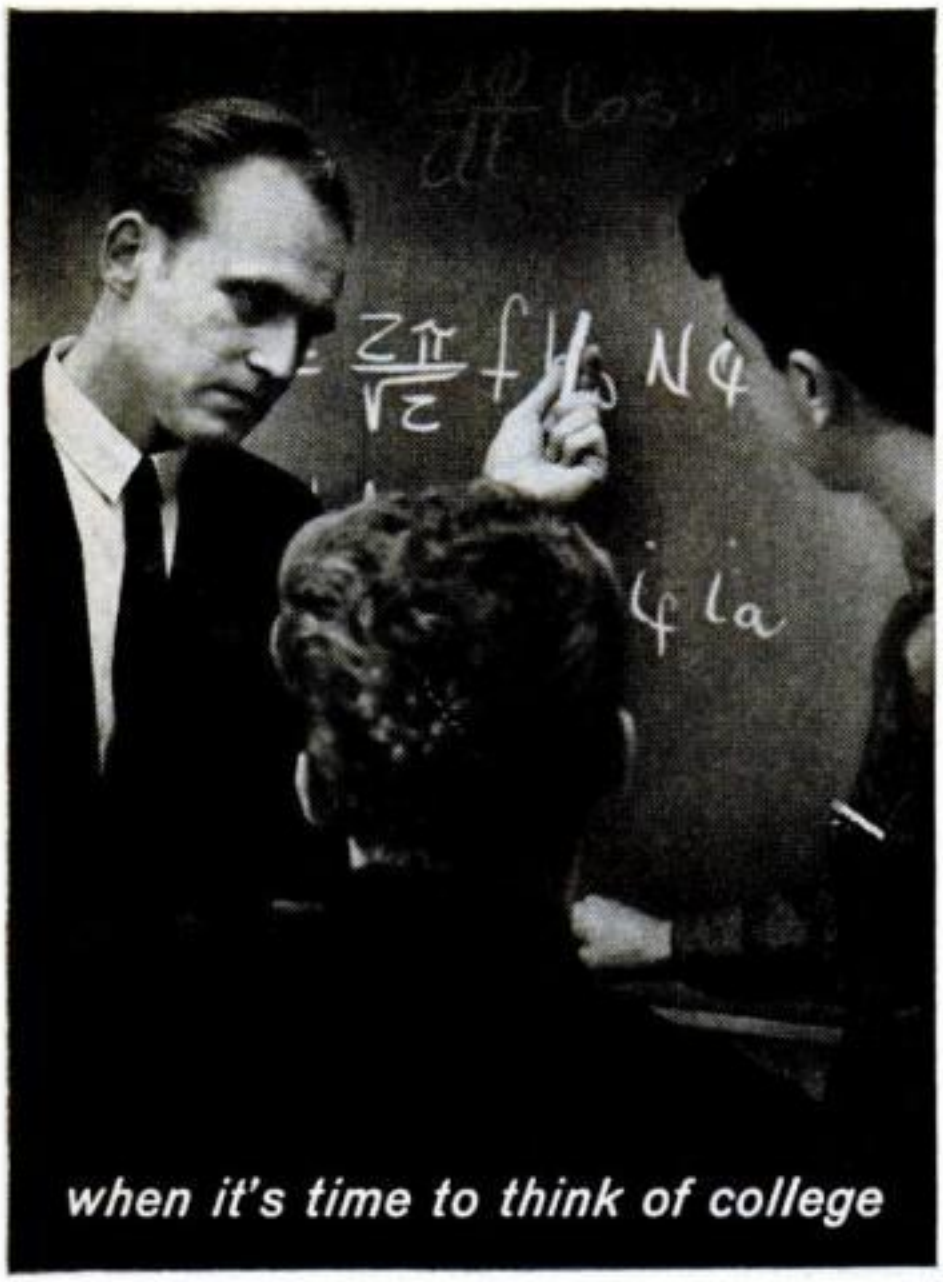

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Smokey Yunick continued

sedan has 6.50-by-14 tires. Is there space on the rims for 7.50 or 8.00 tires, and would it cause any great difficulty to switch over?"—F. R. DiFranco, Ridgewood, N.J.

I doubt that you'll find the rims are wide enough for the 8.00 tires. The 7.50 should fit, but probably will affect the final-drive ratio and put the speedometer in error. Your dealer is equipped to correct that.

"When I bought my '64 Chrysler I was told that the crankcase was filled with a special oil, 'For Service MS,' that wouldn't have to be changed for 4,000 miles or three months, and that I would only have to add oil as needed during this period. Is this really safe, or should I get some 'break-in' or flush-type oil?"—Orville Grayson, Albuquerque, N.M.

Do you bite free silver dollars to see if they're okay? This oil, thoroughly tested by company engineers, is the best you can get for the purpose. You'll be safe following the factory recommendations.

"The brakes on my Rambler American were completely replaced in January, adjusted in April. They still make a loud noise, like springs springing (don't laugh, I'm a woman) when I brake to a full stop. What now?"—Mary M. Hurley, Bridgeport, Conn.

I'd as lief play with dynamite as laugh at a woman. Sounds like your Rambler has snapback. When the brake drums were turned, they were probably left too rough. This would cause the shoes to grab, and follow the drums over, in a hard stop. Then they'd snap back, making the noise you hear. Have the drums pulled off again and properly finished, and the noise will stop.

"What should Indianapolis do to prevent accidents and fires like those that killed Dave McDonald and Eddie Sachs?"—Ron Reynolds, St. Paul, Minn.

It isn't only up to Indy. Everybody involved in racing should concentrate on developing fuel containers that won't shatter on impact. Other measures that might help: 1) Find a safer location for the fuel tank. 2) Limit the fuel to smaller amounts. 3) Do more research toward perfecting automatic fire extinguishers that would go into action on impact. 4) Develop clothing that was really

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Smokey Yunick continued

fireproof. You could write a book in answer to your question.

"At slow speed or idling, my '56 Buick smells strongly (always has) of half-burned gasoline. The original Stromberg carburetor was replaced with a new Carter, but that didn't help. Would transistorized ignition, with a hotter spark, help? New plugs, points, and tune-ups have had no effect."—T. J. Knight, NYC.

This was a chronic complaint with the '56 Buick. It is not caused by faulty ignition. A transistorized setup won't help. Check the fit of the carb on the manifold. You'll probably find that raw gas seeps from the carb onto the hot manifold at low engine speed. Get a better fit, and if possible include a metal plate to evaporate the fuel before it hits the manifold, and you'll come up with a sweet-smelling car.

"They say heat kills batteries, so why do they mount them in the hottest part of the car? Could I mount the battery of my '61 Dodge in the trunk and run a cable up to the front? What size cable?"—Clyde Riall, Vernon, Tex.

Heat and batteries are enemies, all right, so mount the battery anywhere you like—providing the cable isn't more than 36 inches long. Voltage drops in direct proportion to the length of the conductor. By moving it to the trunk, you'd probably wind up with a battery that would last forever, but it wouldn't start your car.

"We have a standard shift in our Chevy six. I shift into second gear to stop (when possible), braking only at the end. My wife uses the brakes to slow or stop. Which is better?"—Peter Kulka, Bellevue, Ohio.

I'm betraying us males to say it, but your wife is right—mostly. Abusing the drive train might save brakes, but will cost more in the long run. The best method is to leave the car in high gear, letting engine compression slow you down before a stop, then brake.

• •

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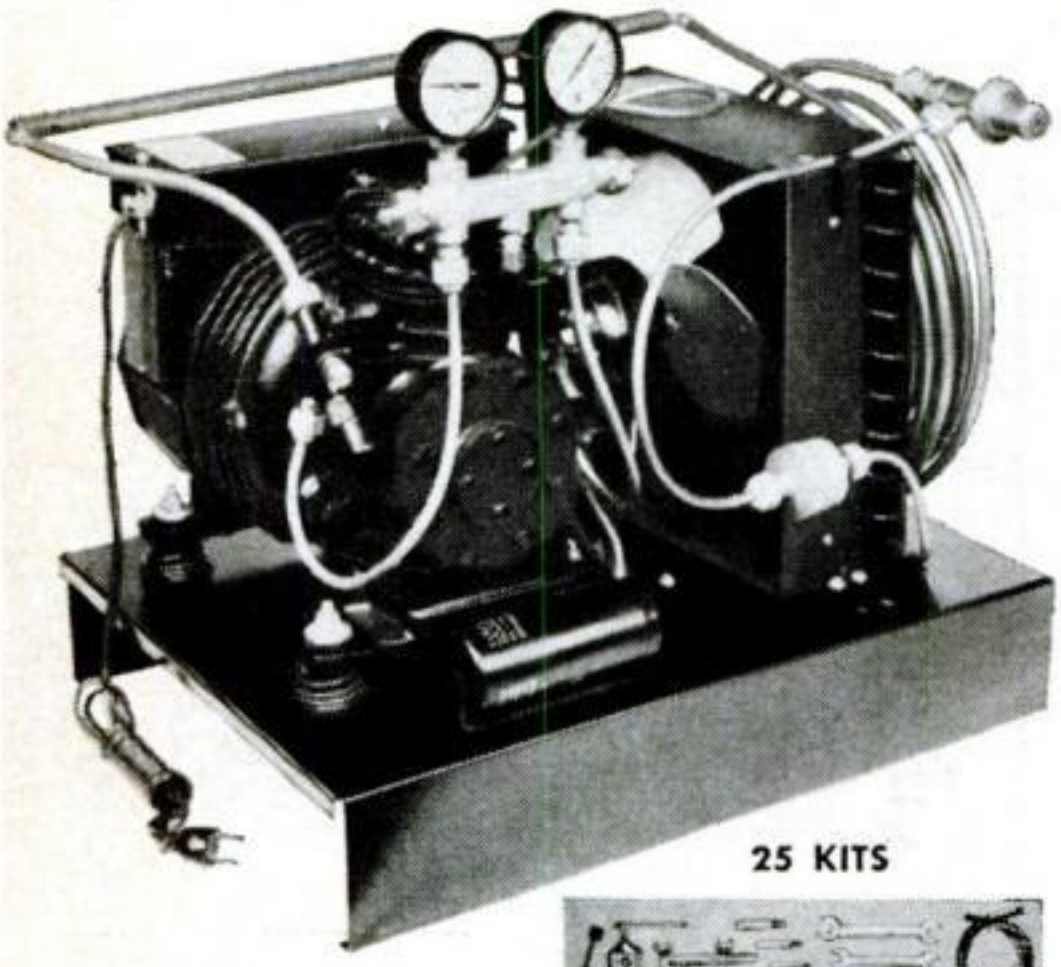

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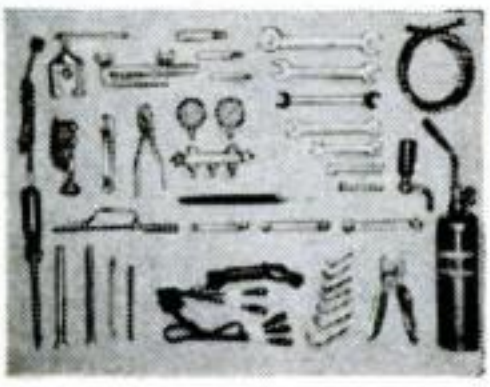

Above—This is how your heavy-duty refrigeration system will appear after it is built. All parts are new and late model. A work project accompanies each kit. *Right*—You also get mechanic's tools, including wrenches and flaring tubes; also gauges, propane torch.

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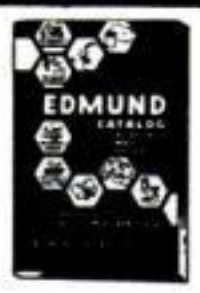

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Science newsfront

A MONTHLY REPORT:

What's going on in science—last-minute news and notes

BY WALLACE CLOUD

IN THE aftermath of the Russian three-man Voskhod space flight, which included a doctor and an engineer as well as a pilot-cosmonaut, the National Aeronautics and Space Administration announced that 10 to 20 scientist-astronauts will be recruited for the U.S. space program. Applicants must be less than 35 years old and have a doctorate in the natural sciences, medicine, or engineering. Women are not excluded.

• *The Davey Crockett infantry weapon, the Army's smallest nuclear fieldpiece, may be withdrawn from use. The mortarlike weapon can fire either a conventional round or a nuclear warhead with explosive power equivalent to about 40 tons of TNT, but field commanders are reported to be dissatisfied with its accuracy. Intended to be used to support ground troops, it is thought to be inaccurate enough to endanger the front-line troops being supported. Officers prefer the highly accurate 155-mm howitzer, for which an atomic shell is being developed.*

• The first blood test for detecting cancer, developed by Dr. Sergio De Carvalho of the Rand Development Corp. and Doctors Hospital, Cleveland, is being evaluated by cancer research centers all over the U.S. Early tests, using over 1,000 blood samples from cancer patients and people without cancer, showed reliability of better than 95 percent, according to Biochemical Procedures, Inc., a California firm also involved. The test does not identify the site or kind of cancer, but may give an early warning signal. Dr. De Carvalho, an established cancer researcher, says he has isolated unidentified substances characteristic of human cancer tissues; injected into animals, they produce antibodies that react with human blood serum to give a clear indication of the presence or absence of cancer.

• Psychiatrists have always assumed that the sleepwalker is acting out a dream, but UCLA researchers who monitored the brain waves of eight sleepwalkers found that the activity was associated with brain-wave patterns characteristic of deep, dreamless slumber—even though the somnambulists moved about with their eyes open, avoiding obstacles. Thus, the mystery of why some people walk in their sleep is deeper than ever.

A "nuclear detective" looks at China's atom bomb

To an atomic scientist, what are the implications of China's atomic bomb? We asked Dr. Ralph E. Lapp, a physicist who participated in the World War II Manhattan Project to develop the U.S. A-bomb, and later headed weapons-development groups in the Department of Defense.

"I estimate that Red China's initial production rate is on the

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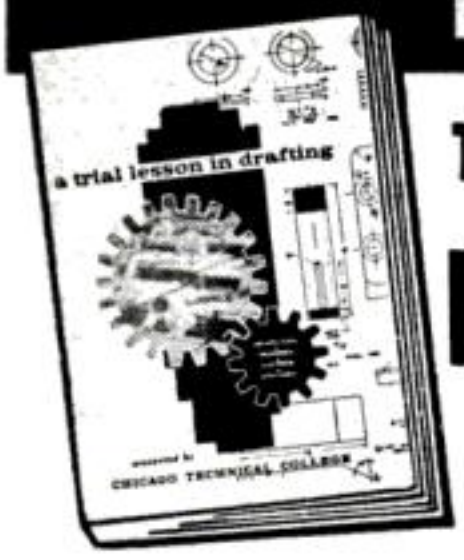

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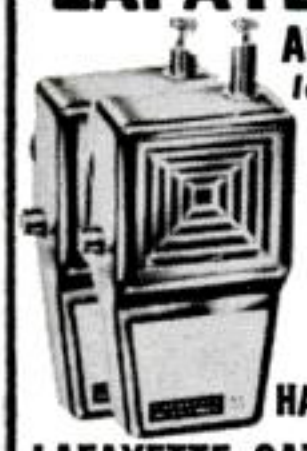

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Science newsfront continued

order of one atom bomb per month," he said. This was based on his knowledge of nuclear-weapons technology.

Much could be deduced, he said, from the Atomic Energy Commission's terse statement (a few days after President Johnson's October 16 announcement that China had detonated "a crude nuclear device") that analysis of fallout showed the nuclear explosive was uranium-235, triggered by the "implosion" technique.

"The surprise was that the U-235 bomb should be the first horse to reach the wire," said Dr. Lapp. Many experts had expected that China's first atom bomb would use the man-made element plutonium, which can be produced in nuclear reactors built to generate electric power. The first bombs tested by all the other nuclear powers—the U.S., Russia, England, and France—have been plutonium bombs.

There had been reports that China was building a gaseous-diffusion plant to separate the 0.7-percent of fissionable U-235 from the 99.3-percent of stable U-238 in natural uranium, but it was generally believed that China could not yet operate such a plant successfully—until the U-235 bomb was exploded.

A diffusion plant, Dr. Lapp said, "takes one whale of a lot of stainless steel—just miles and miles of it. It takes in general a highly advanced technology to make one. It's an automated factory complex, and it also requires a great deal of backup from other industries."

Having both a diffusion plant and reactors enables China to produce "a flood of bomb material," he said. U-235 from the diffusion plant can be added to the natural uranium in a reactor's fuel rods, and this steps up conversion of U-238 into plutonium in the reactor.

The implosion-type trigger used in China's first A-bomb was an indication of highly skilled research and development. In an implosion bomb, charges of TNT surrounding pieces of fissionable material slam them together to make a lump of "critical mass," in which a chain reaction can take place. "Implosion techniques," said Dr. Lapp, "require much more sophisticated timing, machining, and fabrication techniques for ordnance. Fusing the explosive charges so you can get simultaneous

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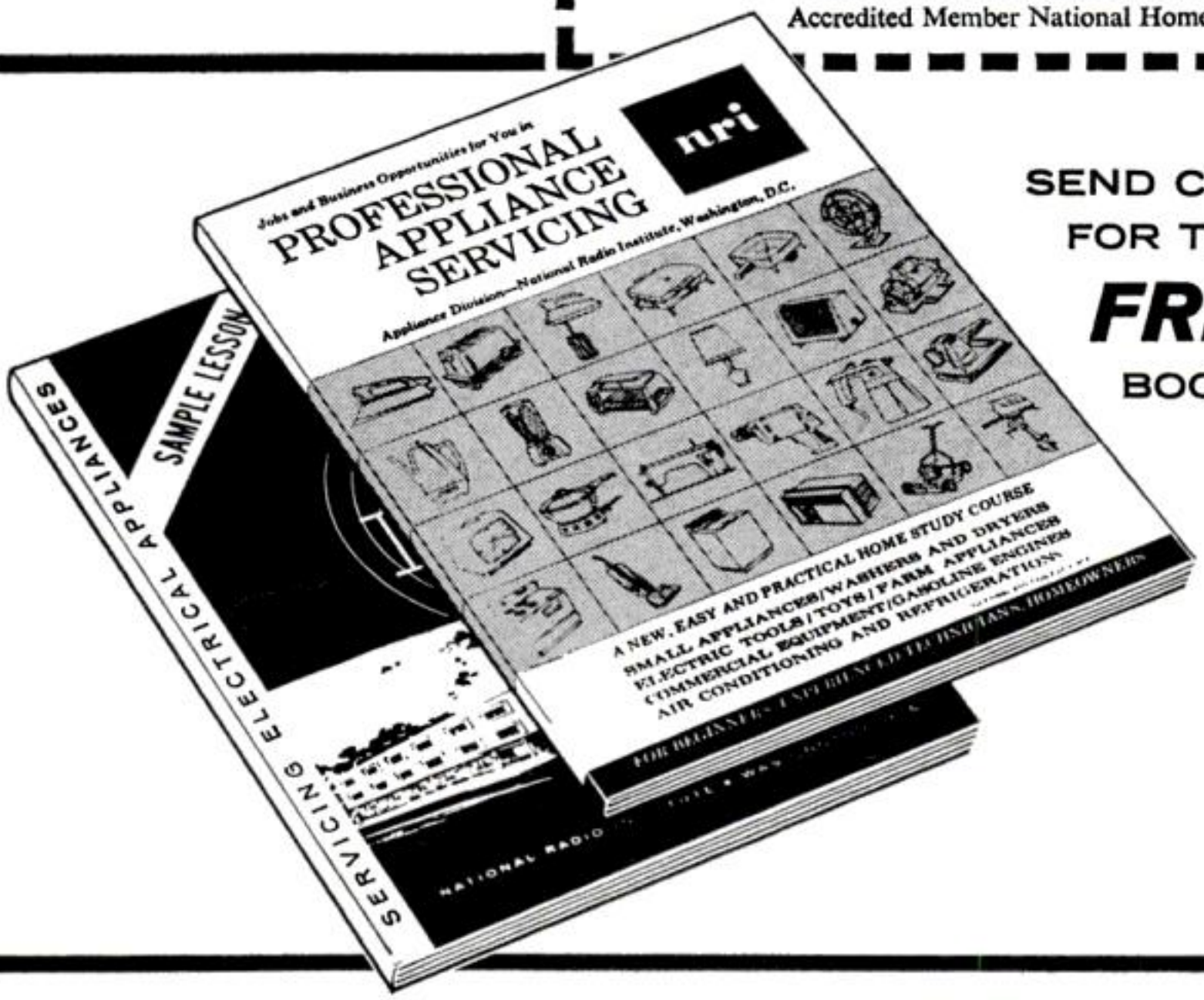
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Science newsfront continued

arrival of the compression wave—measured in fractions of a millionth of a second—takes good electronic knowledge."

Dr. Lapp thinks the Chinese developed their nuclear-weapons technology almost from scratch in a little over three years, following the split between China and Russia in 1960. Before that time, all the important Chinese physicists were working at the nuclear-research center at Dubna, in Russia, so they couldn't be working actively on the bomb project.

● *A mysterious ailment called the "tired-child syndrome" has been linked to television watching in a study of children of Air Force men. The symptoms—among children from 3 to 12 years old—are chronic fatigue, loss of appetite, headache, and vomiting. Sufferers were found to be watching TV from three to six hours on weekdays and six to ten hours a day on weekends. Television time among normal children averaged 2½ hours on weekdays and six hours on weekends. Cutting out TV viewing, or reducing it sharply, eliminated within a few weeks the symptoms of what Air Force medical officers called an addiction to television.*

● **If mice had been responsible for inventing the wheel that rolls, it probably wouldn't have been invented. At least you might conclude that from a study of their preference in exercise wheels, conducted by UCLA zoologists. Mice given a chance to work out on both round and square exercise wheels, then offered a choice between them, generally preferred the square ones. Researchers think it's because mice prefer the challenge: Square wheels require more split-second timing and co-ordination—mice running in square wheels have to jump corners as often as nine times a second.**

● Physicians at the National Institute of Psychology in Italy have discovered that the changes in brain waves produced by drinking wine are different from those caused by consuming an equal amount of alcohol in the form of dry martinis. Wine drinkers responded less to things going on around them; martini drinkers presumably got happier—they responded less to stress. ■ ■

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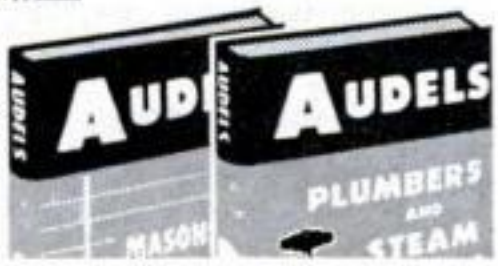

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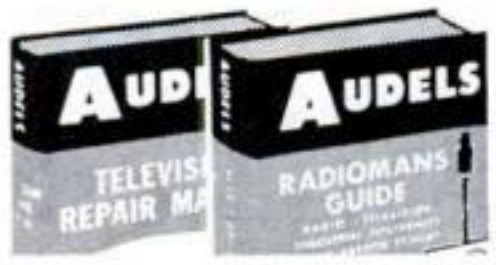

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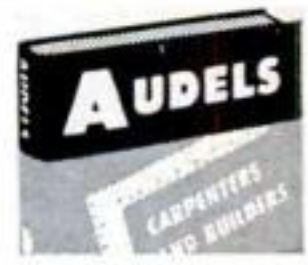

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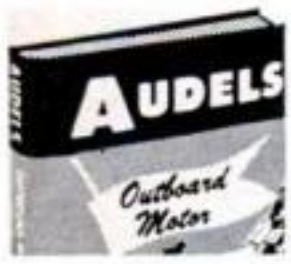

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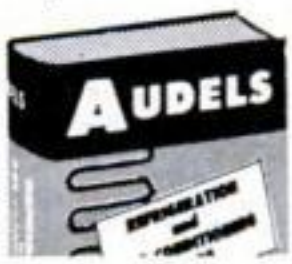

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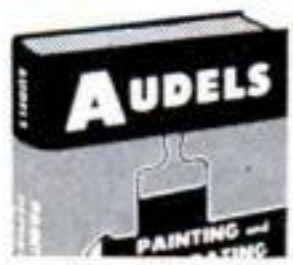

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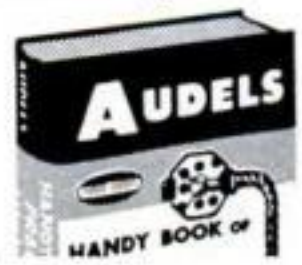

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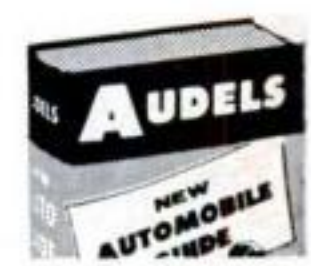

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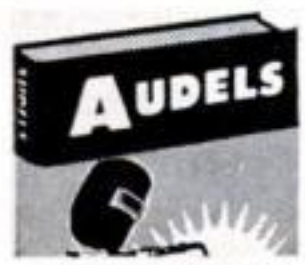

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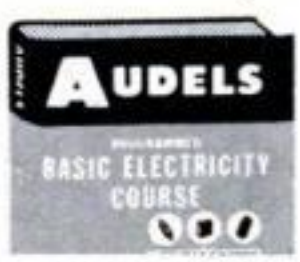

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Getting Ahead

A monthly column to help you prepare yourself for a better job

By Dr. Lewis R. Fibel

ARE you interested in work with animals? The American Society for the Prevention of Cruelty to Animals (441 E. 92nd St., NYC 10028) is offering a 12-week course for laboratory-animal technicians.

• A new guide to jobs in the building trades, "Know Your Union" (Dorrance & Co., 1715 Walnut St., Philadelphia 3), includes informative chapters on the selection and training of apprentices.

• Parlaying a hobby: Photographic-science students who graduated last June from the Rochester (N.Y.) Institute of Technology averaged starting salaries of $7,500. Actual range ran from $6,500 to $8,000.

"How can I get to be a police photographer?"—H.L.W., FPO, NYC.

One way is to start as a police officer and then get the additional assignment to photography. In only the largest police systems would it be a full-time job.

You can learn photography by self-study, correspondence courses, or attendance at trade schools. The Navy teaches photography. Perhaps you can study it there.

What correspondence schools offer home-study courses in foreign languages, particularly Slavic and Asian dialects?"—R.I.P., Alpena, Mich.

Many colleges that belong to the National University Extension Assn. offer foreign-language recordings or tapes for instruction. (A complete list can be obtained for 25 cents from the Business Office of the University of Minnesota, Minneapolis 14.) Here are a few examples:

Arabic—U. of Wisconsin (Madison).
Japanese—U. of Oklahoma (Norman).
Korean—U. of Washington (Seattle).

 CONTINUED

TUNE UP ELECTRONICALLY ANY CAR EVER MADE...

domestic or foreign; compact or limousine; 4 cylinder, 6 cylinder or 8 cylinder; 6 volt or 12 volt.

With New Improved Model BT-162

DWELL TACHOMETER

NOTE: GIANT 6½" METER FOR EASY, ACCURATE READINGS

At last a streamlined instrument designed to provide the most important services for "tuning up" any and every car ever made from a Model A Ford up to and including the current automatic transmission cars produced today.

The Model BT-162 includes the very latest design Dwell Meter, working in conjunction with a dual range Tachometer and incorporating all modern improvements in circuitry design.

Assure easy starts, optimum performance and maximum gas economy with Model BT-162.

The Model BT-162 will perform the services specified below in addition to many other tasks too numerous to mention:

- Assure precise adjustments of points that are slightly worn or pitted.
- Indicate the most effective point setting without removing the distributor cap.
- Indicate the correct settings for external adjustment type distributors. (A feeler gauge cannot be used for making correct adjustments on this type of distributor since many manufacturers' specifications do not list the point gap in inches. They list only the dwell angle in degrees.)
- Insure maximum gas economy and quiet engine running. Read the exact RPM while the engine is in neutral position. Then adjust the carburetor in conformity with the car manufacturer's recommendations.
- To locate a "miss" you need only disconnect or "short" the spark plugs one at a time with the Model BT-162 switched to the Tachometer position.
- Cars with automatic transmissions function efficiently only if the fluid pressures are correctly maintained and since manufacturer's instructions always refer to RPM, the Model BT-162 (or an equivalent tachometer) is required to properly service automatic transmissions.

Specifications

The Model BT-162 provides three dwell angle scales; 0 to 45 degrees, 0 to 60 degrees, and 0 to 90 degrees. The three dwell angle ranges specified above make this instrument suitable for making accurate dwell angle adjustments on all 4 cylinder, 6 cylinder, and 8 cylinder cars, both foreign and domestic.

The dual range tachometer is extremely versatile since it provides both a low range of 0 to 1000 RPM, necessary for making precise carburetor adjustments and the high range tachometer, 0 to 5000 RPM suitable for making all other tests at high engine speeds.

The Model BT-162 is the most complete unit in its price range ever produced. It comes absolutely complete, ready to use. Only $29.95

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Try it for 10 days before you buy. If completely satisfied then send $5.00 and pay the balance at the rate of $5.00 per month until the total price of $29.95 (plus small P.P. and budget charge) is paid. If not completely satisfied, return to us, no explanation necessary.

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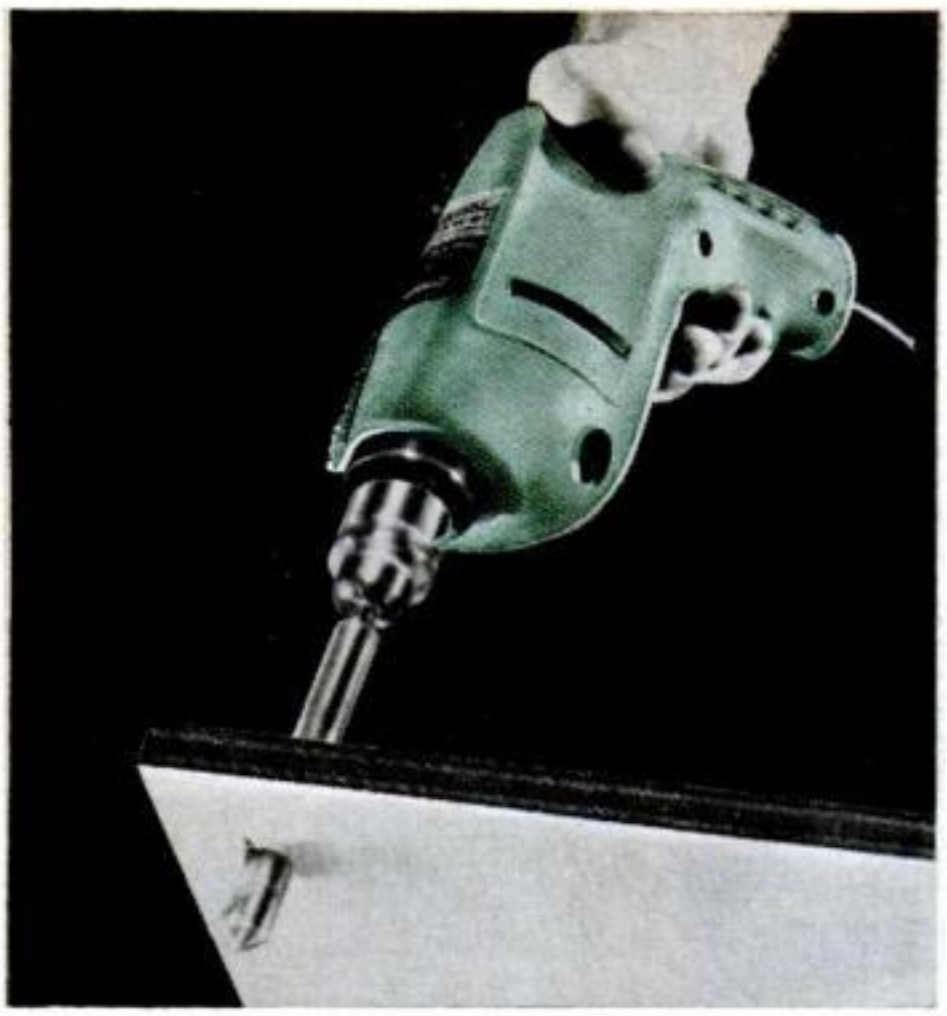

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Getting Ahead continued

Polish, Russian, and Serbo-Croatian—U. of Minnesota (Minneapolis).

Several private schools that are members of the National Home Study Council also offer correspondence courses in foreign languages. Again, some examples:

American School, Drexel Ave. at 58th St., Chicago 36; The Hadley School for the Blind, 700 Elm St., Winnetka, Ill.; International Correspondence Schools, Scranton 15, Pa.; La Salle Extension University, 417 South Dearborn St., Chicago 5; National School of Home Study, 230 Park Ave. South, NYC 3.

"Where can I study in the U.S. to be an industrial chemist?"—S.W.I., Lagos, Nigeria.

There is no difference in the basic training of an industrial chemist and any other kind. All hold a bachelor's degree with a major in chemistry. For career data, write the American Chemical Society, 1155 16th St. N.W., Washington 6, D.C.

Over the Air: Individual Instruction

A revolutionary new educational system not only beams courses to thousands simultaneously, but permits specified interchanges between instructor and student. The first Educasting Center to go on the air has just been opened by the International Correspondence Schools.

The student uses either closed-circuit FM or TV. He has four buttons for answering multiple-choice questions. If he gives the wrong answer, the system tells him so, tells him why, and gives him the right answer and an explanation. TuTorTape Laboratories, NYC, conceived the system.

"Are there schools for radio announcers or disc jockeys?"—K.G., Menominee, Wis.

A number of vocational schools offer training. Among them: Detroit School of Announcing, 138 Duffield St., Detroit; Brown Inst. of Broadcasting, 3123 E. Lake St., Minneapolis; Northwest Radio and Television School, 1221 N.W. 21st Ave., Portland, Ore.; De Vry Technical Inst., 4141 Belmont Ave., Chicago 41.

Some universities also offer courses.

CONTINUED

Urheberrechtlich geschütztes Material

Where is that Young Man Who was *You*?

Where along the way did he get side-tracked? When and why did he give up his dream of a wonderful future and resign himself to a life of grubbing? Can his hope be revived? Is there still time to make his dreams come true? For some men, it is not too late. If you are one of these, you will want to send for a free book that may change the entire course of your life, may put you back on the road to prosperity and personal independence.

By Grant Mauk

Grant Mauk

It is natural for a man to dream. Without dreams of a better future we wouldn't have much to live for. *But to make our dreams into reality, they must be put to work! They must lead to action.* Otherwise they can rob us of all ambition and all initiative. How, now, can you turn your dreams into realities? How can you direct them into productive channels? How can you forge them into the weapons you need to achieve success in life?

Almost every man will agree that it is difficult to be truly successful as long as he is chained to a routine job—and a fixed income. If you are a union man, the wage scale puts a limit on your earnings. If you work for a salary, you know from experience that raises are few and far between. In either shop or office the opportunities for advancement are too few, too slow to come.

What's the solution to this problem? You may find the answer—as so many other men have found it—by starting a business of your own. Don't let the idea scare you. There is now a way for you to do this without giving up your present job—without losing a single pay check.

Don't for one moment think that starting your own business is a risky, dangerous and costly undertaking. At one time this may have been the case. But it is the case no longer. The facts that reveal the truth are outlined in a big 24-page book now available free of charge to any man who is sincerely interested in banishing fear, doubts, and misgivings from his life.

This book tells you how to start a Franchise business in your spare time without giving up your present job! If you happen to be unemployed at the present time, this book may be the answer to your problem. Among other things, the book shows you how to build a profit of $250 a week in a one-man operation—even more if you hire others to do the work. The 24-page book also shows you how to start for a few hundred dollars, how we finance nearly three fourths of the total cost of getting started—and how you can pay the balance in monthly payments so small that less than one day's work will cover them.

In the past, a man who started his own business often failed because (1) he went into a declining or overcrowded business, or (2) he knew nothing about business management.

The Franchise business has changed all this. Ours is a Franchise business that has been tried and tested and proved. Our plans for success are clearly charted. The market for our service is growing steadily. A great many men have been highly successful in this business. We lay out the Plans for a new man and provide all the training and equipment he needs. Success is the logical result.

The business I am talking about is one of the fastest growing service businesses in America today. No office or shop is needed. If you have a telephone at home and a car with space in the trunk, then you have everything you need except what we furnish. Business comes to you on the telephone and in personal calls from leads we furnish. These leads come from National Advertising and from your own local Direct Mail Plan which we also furnish. You quote your price to the housewife, do the job or have one of your men do it and collect the money on the spot.

The work includes six services. The most important is cleaning rugs, carpets and upholstered furniture right in the customer's home. Cleaning is done by a revolutionary process called the Absorption Method. There is no harsh scrubbing with motor-driven brushes, no soaking with gallons of water.

Instead, an Aerated Foam gently loosens the greasy atmospheric dirt and holds it in suspension so it is easy to remove. A recent test made by an independent laboratory showed that machine scrubbing in the home removed less than half as much dirt as was removed by the Absorption Method.

This kind of cleaning, however, is only one of six different services you offer the housewife. Each of the six services is the source of an important profit. Everything about these six services is explained in the book we will send you. Pictures and descriptions show how the work is done, how to start a business without giving up your present job, how to build a full time operation through sales-getting Plans we have worked out for you.

If you are tired of working for others, tired of jumping from one proposition to another and if you have always thought that starting your own business was difficult or risky—this book will open your eyes. It explains why it is easier than ever before to become master of your own destiny in a business of your own. It may lead to a realization of the dreams that were dreamed by that young man who was you.

Send for your copy today. There is no obligation. There is no charge. No salesman will call on you. When you get the book, read it carefully. Then decide if you want to take the next step toward putting your dreams to work.

GRANT MAUK, President, 5-181 Duraclean Bldg., Deerfield, Illinois 60015

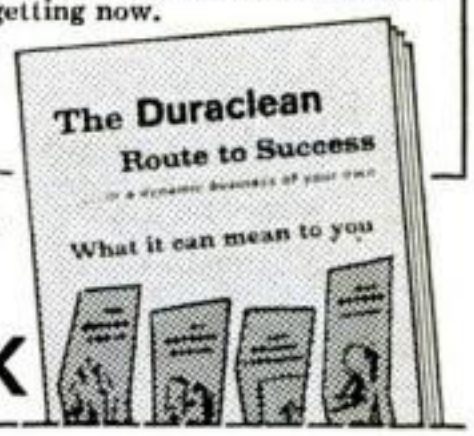
These Men Made Their Dreams Come True

You may be satisfied with a "one man" business. These men operate that way: Ward Whitbeck wrote: *"I have made as much as $225.00 in one day."* L. Lawson says: *"In September, working alone, jobs totaled $1,475."* L. Canaday wrote: *"$1,571 in a single month."* And G. Byers reported, *"On one institutional job my charge was $2,416.—total expenses, $814.00."*

If you wish, you can operate as the head of a multi-crew business with others doing the service work. You do the selling, write up the orders, direct your crew, and do the banking. These men have one or more others working for them:

Ed Kramsky wrote: *"In my second year I now have two assistants, a nice home and real security for my family."* And E. Davis reported *"Gross income increased $17,660 this year."* Carl Smith wrote, *"Earned $650.00 in one week. Our volume is getting bigger all the time."*

These are exceptional earnings, but they show what can be done when a man buckles down to business and makes a real effort to forge ahead. If they do nothing else, these earning records should act as an inspiration and incentive to a man who wants to harness his dreams and get more out of life than he may be getting now.



Send Name for this FREE BOOK

Grant Mauk, President

5-181 Duraclean Building, Deerfield, Illinois 60015

Dear Mr. Mauk: Please mail a copy of your Free Book that tells how I can get a Duraclean Franchise started in spare time without giving up my present income. No charge. No obligation. And no salesman is to call on me. After reading your book I will let you know my decision.

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You can have your own lifetime business right at home . . . work in spare time . . . and make up to $200 a month CASH! My FREE PLAN gives you all the facts: How to start, how to grow. You don't need previous experience. You don't have to sell. I'll even finance you. People bring you the work and pay cash. Over 90c of every dollar you collect is clear cash profit. And you work when you want to. Let me prove you can't find a more certain, lower cost, higher paying business of your own.

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BELSAW SHARP-ALL CO., Stan Field, President
705G Field Bldg., Kansas City, Mo., 64111

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. . . and years of future security in the multi-billion dollar construction industry, in this country and *overseas!* Learn how at National, the original school of heavy equipment operation. For men ages 17 to 56. Amount of previous *education no barrier.* National is NOT a correspondence school. You train on school-owned diesel-engined machines at National's huge proving ground in North Carolina. Full 220 and 440 hour courses. Full-time Job Advisory and Counselling Director for the exclusive benefit of graduates. VA approved. Payment plans available. Write TODAY for FREE catalog.

Since National School was founded nine years ago, students from all 50 states and 28 foreign countries have been enrolled. Hundreds of graduates are now working in construction for higher wages than they ever made before.

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Please send me FREE illustrated school catalog and complete information. I understand there's no obligation.

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Address.....

City.....**Zone**.....**State**.....

Getting Ahead continued

"I'd like a career in color TV. Please list schools."—P.S., New Rockford, N.D.

There are many kinds of work in TV (all requiring a background in black-and-white, too). If you're interested in servicing sets, you can get career pamphlets from Personnel Services (50 cents), Main St., Peapack, N.J.; Science Research Associates (45 cents), 57 W. Grand Ave., Chicago 10.

A large number of schools offer courses, including courses on color sets. A sampling: RCA Institutes, 350 W. 4th St., NYC 10014 (resident); Massey Tech. Institute, Jacksonville 6, Fla. (resident or correspondence); American Technical School, 923 8th St., Des Moines; American Institute of Engineering & Technology, 1143 W. Fullerton Parkway, Chicago 14 (resident or correspondence).

"Would a mechanical engineer need further training to be a nuclear-reactor operator?"—R.C., Bridgeport, Conn.

There are 10 nuclear-power stations for generating electricity. Of their 633 workers, 100 are nuclear-reactor operators.

To qualify for an AEC license, a reactor operator must have experience in power-station operation and 6 to 12 months of on-the-job training on reactors.

Your degree may well qualify you for some more-technical work in the atomic-energy field. Investigate that also.

"Do any colleges offer home-study courses for a degree in government or in political science?"—M.B.B., Austin, Tex.

No. But members of the National University Extension Assn. (all accredited) do offer courses in these fields, and many will credit *some* correspondence work toward a degree.

For information, address Correspondence Study at: College of General Studies, U. of Hawaii, Honolulu 14; Mass. Dept. of Education, 200 Newbury St., Boston 16; U. of No. Carolina, Chapel Hill; U. of Texas, Austin 12; Washington State U., Pullman.

• • • •

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Every repair or adjustment is broken down for you into numbered steps — each clearly illustrated with action-type photos or drawings. There are *more than 3000* photos (including *NEW fluorographed photos*), detailed diagrams, exploded views. You SEE exactly how to strip down every part of the car from headlight to tail light . . . service it . . . assemble it again. You never have to puzzle out confusing instructions, or wonder where the smallest part goes.

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To get your copy, send $9.95 to Chilton Books, Dept. PS-15, 227 So. 6th St., Philadelphia, Pa. 19106. Examine the book for 7 days — and then, if you wish, return it in clean, undamaged condition for full refund. Mail coupon today.

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- Complete repair information on *every part of the car:* engine, carburetor, transmission, electrical system, brakes.
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- Big troubleshooting section, *NOW EXPANDED.*
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- Complete electrical diagrams, *NOW EXPANDED.*

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Chevy II	Olds F-85
Chrysler	Plymouth
Comet	Pontiac
Coronet	Rambler
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Urheberrechtlich geschütztes Material

HOW TO GIVE YOUR CHILD THE TOP

YES, HERE IS YOUR CHANCE TO MAKE SUCH A DIFFERENCE IN YOUR CHILD'S PERFORMANCE IN SCHOOL THAT THE TEACHER MAY ACTUALLY CALL YOU UP TO SEE WHAT HAPPENED.

And you can do it in as little as five or ten minutes of your time every day. Here's how:

By EUGENE M. SCHWARTZ, Pres.
Executive Research Institute, Inc.

Let me explain. I believe it makes no difference whether your child is six years old or sixteen — boy or girl — in grade school, high school or college. It makes no difference how badly that child is doing in school today — how difficult it is for him to concentrate . . . how poor his memory may be . . . how much a prisoner he is of crippling mental habits . . . how frightened he may be of mathematics, or grammar, or social studies, or even the most difficult science course.

I believe that your child's mind is working today at only HALF its true power — simply because he has never been taught the correct way to make his subjects half-teach themselves.

Simply because he has never been shown the newly-developed techniques of Speed-Reading, that are taught in universities all over America today, and that have him skimming through his printed work as much as **twice as fast** as he reads today, with far better understanding of every word he reads.

Simply because he doesn't know the right way to rephrase the problems he is given in mathematics, so clearly and logically that these problems virtually **half-solve themselves,** before he even begins to work on them.

Simply because he doesn't know the right way to prepare for his tests — so thoroughly that he may actually be able to anticipate most of the questions that his teacher will ask him on that test — **possibly right down to the very phrasing that the teacher may use on those questions.**

Power-Studying Can Be Learned. You Can Teach It To Your Child Yourself, In Far Less Time Than You Ever Believed Possible.

Yes. Speed-reading can be learned. Complicated problem-solving . . . memorizing facts, figures, even whole lessons . . . taking the sting out of tests — all can be learned. The top grades — the brilliant performance in school that your child deserves, **can be taught to him;** he doesn't have to be born a genius to achieve them.

You, yourself, can coax these top grades out of your child. You can do it by showing him the right study techniques. Study techniques developed by private-school teachers, by professional tutors, by writers of speed-teaching adult-education courses all over America.

Study techniques that you and your child probably never dreamed existed. Study techniques so effective that I'm willing to prove them to you in your own home, without your risking a penny.

Here's how:

The First Week After You Use This Book With Your Child, You May Marvel At His Improvement.

All I ask from you is this. Let me send you, at my risk, what I believe is one of the most fascinating books you have ever read. When this book arrives, set aside a few minutes each day from the following weekend. Glance through its pages. Get ready to see for yourself the heartwarming new performance your child can give you in his homework, **once you give him the proper mental tools to work with.**

For example:

Does your child make the same spelling errors, over and over again!

Then turn to page 125 . . . teach him three delightful shortcuts that burn the correct spelling of those problem words into his mind . . . and watch him, from that day on, write those former "trouble-makers" — letter-perfect — as easily and naturally as he writes his own name.

Does he have trouble finding the correct words to express himself in class!

Then turn to page 35 . . . glance over the fascinating word game you find on this and the following pages . . . play this game with your child for a few minutes each day . . . and then watch the excitement on his face as he discovers that he now has hundreds of powerful new words at his command — to make his recitations sparkle — to build thought upon thought correctly and dramatically — to really show off the talent and knowledge he has inside him, when his teacher asks him a question.

Are needless mistakes causing him to continually trail behind his class in mathematics?

Then learn at once the simple tech-

READ THESE THRILLING TESTIMONIALS

From Reviews and Letters Received From Teachers and Private Tutors

(We regret that we do not have the space to reproduce them in full)

Many students do not do well in school simply because they have not mastered basic study techniques. To parents who are concerned about how they can help their children, I recommend Eugene Schwartz's book. The author emphasizes ways of improving reading, writing and mathematics. I especially recommend Mr. Schwartz's section on "Digging Out the Facts — Reading," which comprises the key to the book."

L. W. Block
High School Guidance Counselor
Livingston, New Jersey

"I am a retired teacher — who, after 35 years as a regular in Michigan, continues as a substitute and tutor . . . I like your book for selfish reasons, primarily! It vindicates my 45 years of practice! Your ideas belong IN THE SCHOOLS.

This summer I tutored a boy who had failed in Math and earned a D (70 or less) in English in the eighth grade . . . What he needed was positive aims . . . self confidence. He was accustomed to considering himself "stupid" . . .

This fall, he is not concerned with passing — he is going after A's! . . . We have a new boy on the way! His parents are going to receive instructions for helping him every day — thanks to you . . .

S.R.W.
Orlando, Florida

"Your book helped us to say, in a better way, some of the thing we have been saying to parents for some time.

For an interesting experiment in Duval County (Florida) public schools, would you give us permission to reprint approximately 13,000 of your introduction to your book, for distribution to the home of each first grade pupil."

Mr. & Mrs. J. C.
Jacksonville, Florida

"The singular, striking, overwhelming distinction of this book is the approach of giving parents a way to help.

I'm convinced that any parent could take this book, and measurably improve his child's grades."

G. R. Benson Jr.
High School Teacher of Art
Madjen, N.J.

This book, lucidly and excitedly, because you feel a sense of optimism as you read, teaches the parents how to aid their children to achieve academic success by proper study, memory, and test-taking techniques.

The author of this book, in both the English and Mathematics sections, explains in a clear and logical sequence how the parent, with patience and gentle guidance, can assist the child to learn those various techniques that will mean a higher average in all his school subjects.

It seems most practical to assume that with early preparation in the areas of English and Mathematics, the child will be fully prepared to take the College Board Exams successfully and to move on toward his chosen career with a spirit of confidence.

Mr. Schwartz has performed a valuable service with his important book.

Bernard Hailperin
Teacher-Counselor
Newark, New Jersey

"I have studied this book in every detail and found it very challenging in its concept and teaching methods. It is well worth the small investment.

Mr. A., Private Tutor
Wareham, Massachusetts

"It is an excellent book on how to study."

Mrs. M.
High School Teacher of Latin and English
San Antonio, Texas

From Parents Like Yourself *(and their children)*:

"I thought you might be interested to know that all of my children have had difficulties with their school work. We have talked to teacher after teacher and all they ever seem to say is that they are smart but they are not producing. They never seem to be working up to their capabilities. No one has been able to really produce a concrete solution until now. My mother-in-law sent us this book. I only received it today and I have only read one third of it but it just sounds like the anwer to a prayer. I am only sorry we did not have it years ago."

A.P.S.
Tampa, Florida

"It is well written, well thought out and beautifully organized . . . it is without question, the logical approach!"

Mrs. L.H.K. III
New York City

"Your book contains all the information I needed in the depression years when I attended classes in evening school . . . and information I can still use today in my adult education classes.

M.I.R.
Detroit, Mich.

"It made me aware of how important school is. I had been a hard worker but I did not know what was important . . . This was the smartest thing I ever did. It looked like I was going to come in second every time — not any more."

Christopher W. (15 years old)
Smithtown, New York

"Anyone can understand this book. I am delighted and will recommend it to all my friends. I only wish I could have read it ten years ago."

Mrs. R.D.S.
Portland, Oregon

"I got this book to improve myself in school and what I have read is worth every cent I paid for it. Thank You."

H.L. (16 years old)
Detroit, Michigan

". . . well organized, fast reading, first book I've read which offers concrete ideas about improvement in learning and retention. Wish I'd had this book when I was in school."

Mrs. C.W.W.
Belleville, Michigan

From SCHOLASTIC Magazine

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EUGENE M. SCHWARTZ

When a father worries about the kind of education his son is getting in school — and when that father is also president of a publishing company that specializes in modern learning methods — then sparks really fly.

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Plumbing & Heating
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Paper Making
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Metallurgical Engineering Technology
Patternmaking
Practical Millwrighting
Reading Shop Blueprints
Rigging
Tool Engineering Techn'gy
Toolmaking
Welding Engineering Technology
Welding Processes

STEAM AND DIESEL POWER
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Industrial Building Engineer
Power Plant Engineering
Stationary Diesel Engines
Stationary Fireman
Stationary Steam Engineering

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Carding and Spinning
Cotton Manufacturing
Dyeing & Finishing
Loom Fixing
Spinning
Textile Designing
Textile Engineering Technology
Textile Mill Supervisor
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Wool Manufacturing

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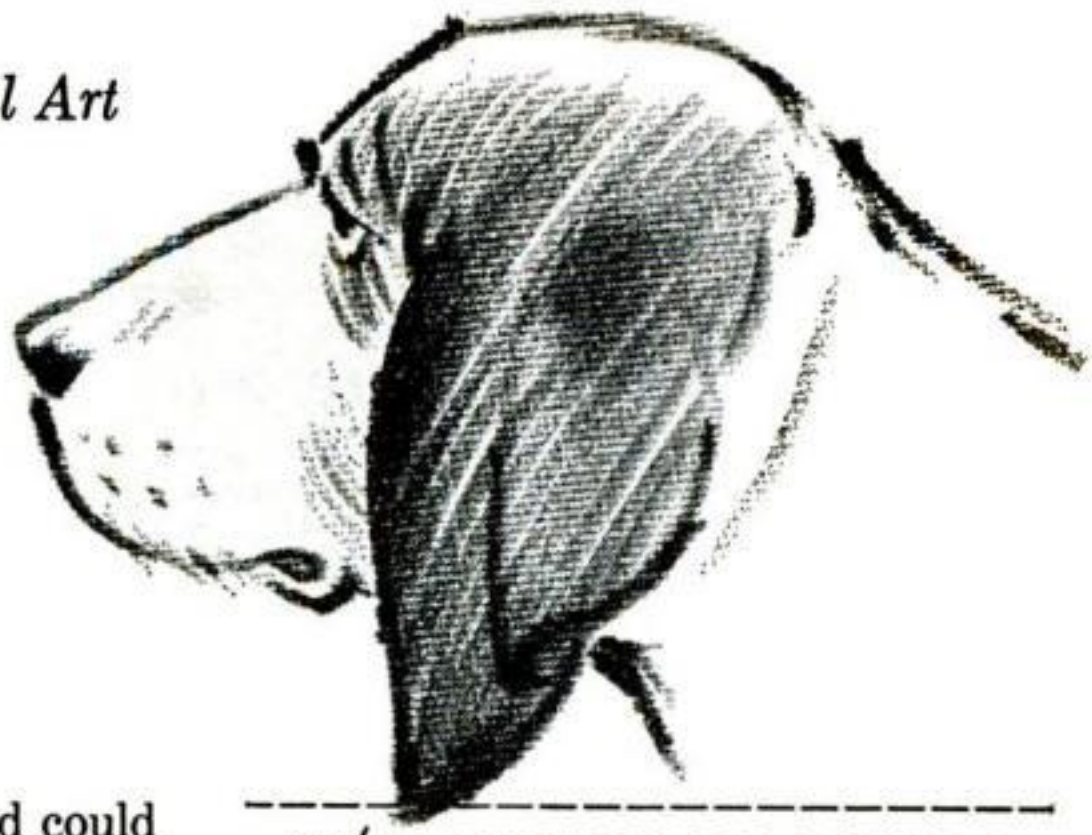

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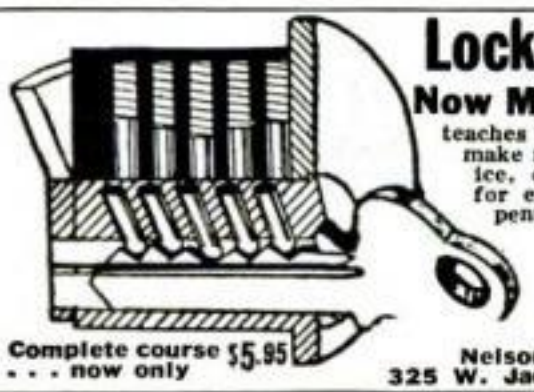

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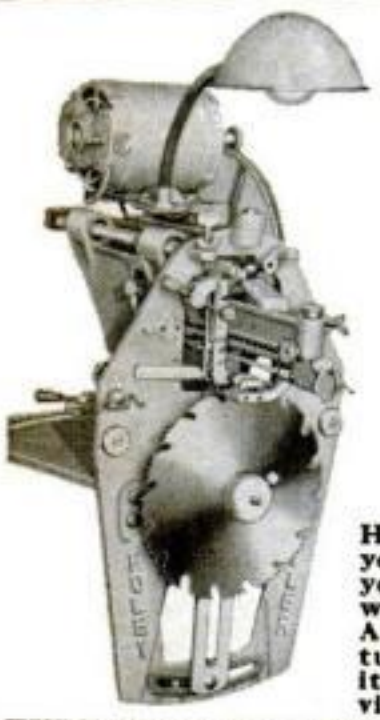

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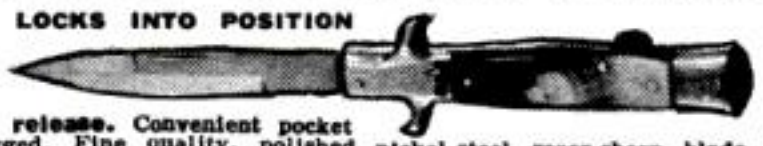

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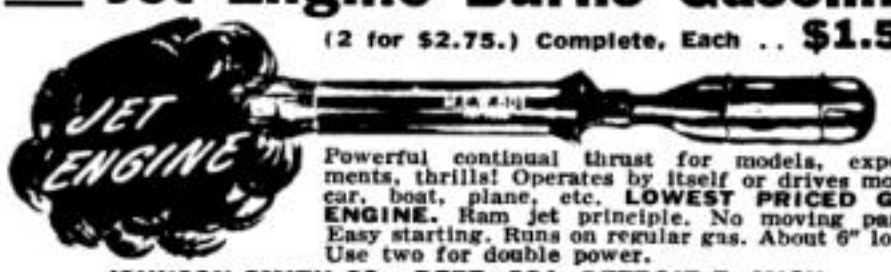

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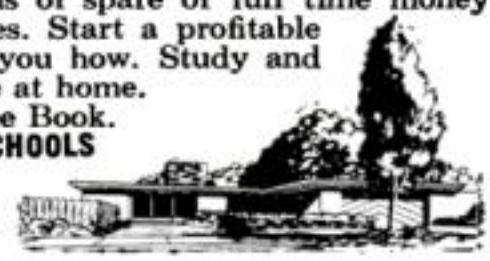

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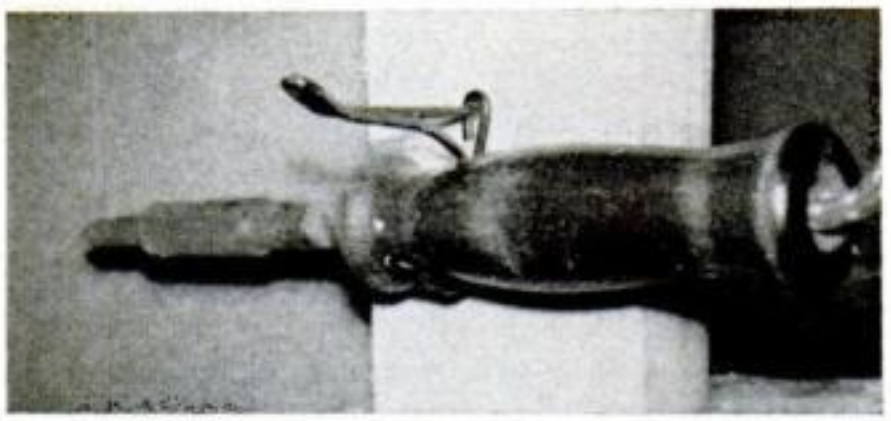
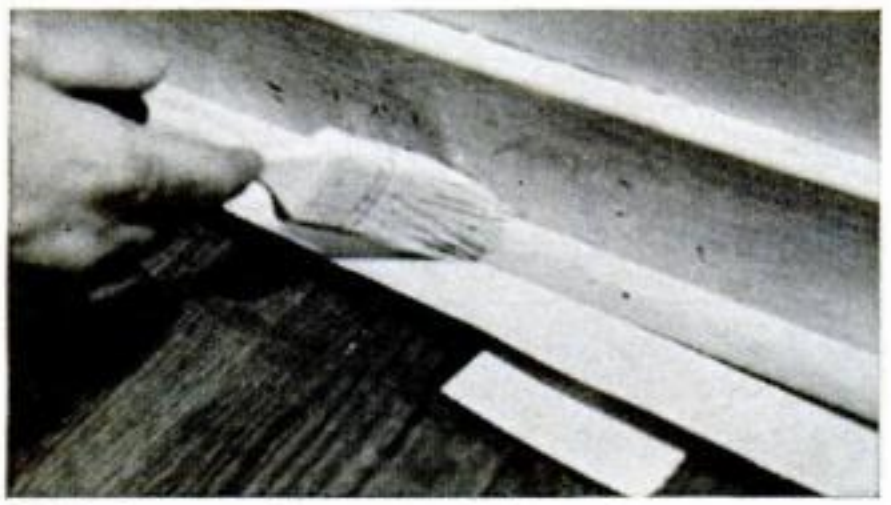


Hook keeps hot iron out of the way

A clothes hook under your workbench will keep a hot soldering iron out of the way, yet available when needed. You may have to bend the hook slightly to hold the iron properly, but otherwise simply screw it to your bench. When the iron is not in use, its cord may be coiled over the upper hook.—*A. W. Bomeli, McKees Rocks, Pa.*

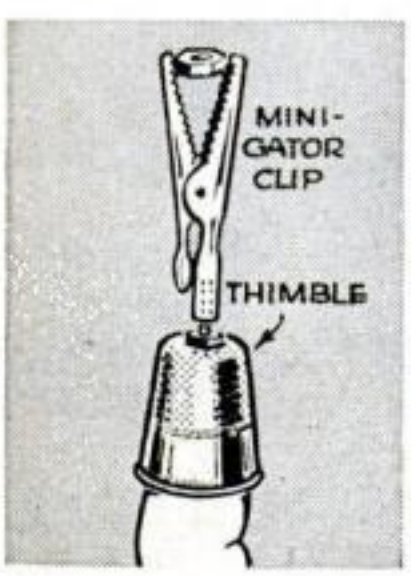


Painting a clean straight edge

An old venetian-blind slat is a handy paint edger. Its slight curve makes it rigid enough to hold a straight line while you paint up to it, and it's thin enough to slip under adjoining woodwork to make a tidy edge.—*A. Weber, Edmonton, Canada.*

Starting a nut with one finger

The problem of holding a nut or starting a screw where two fingers won't fit can be solved with this device. Put a flathead screw in and through the top of a thimble, lock it with a nut, and solder on a tiny alligator clip. As a variation, you can cement a magnet to the flattened top of the thimble.—*Peter Legon, Malden, Mass.*



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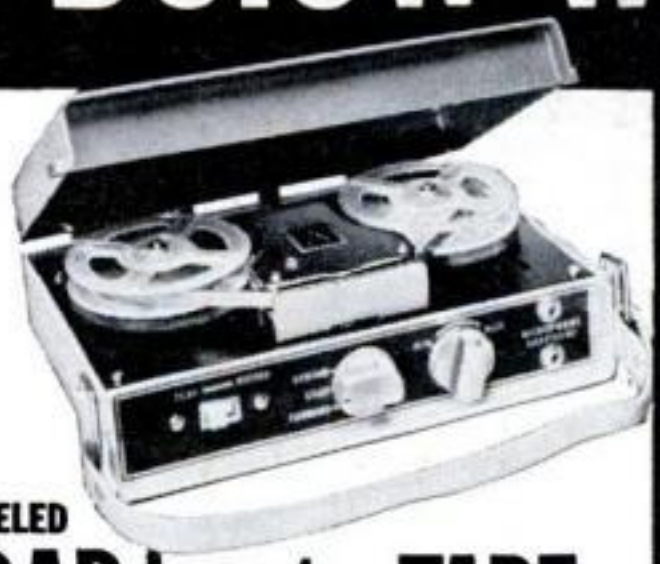

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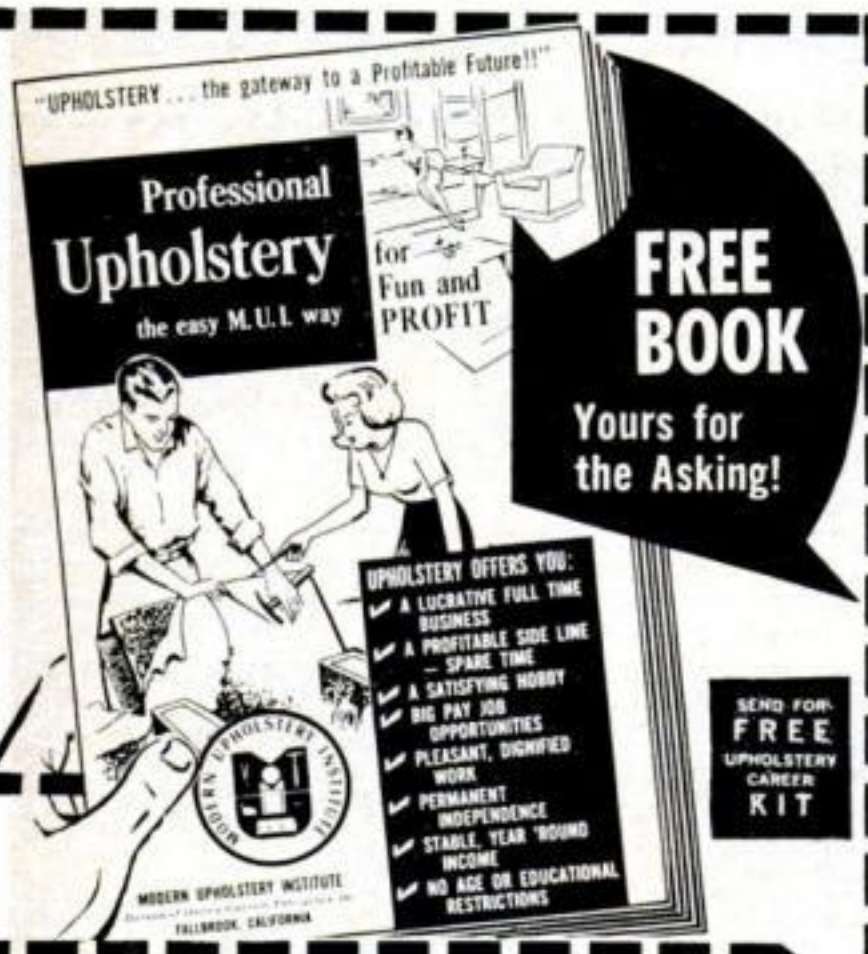

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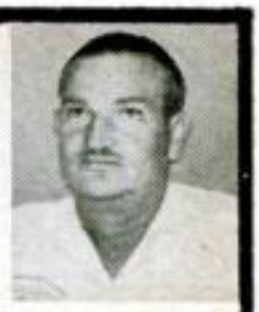

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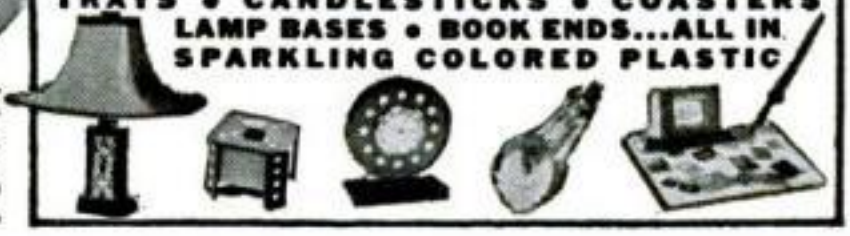

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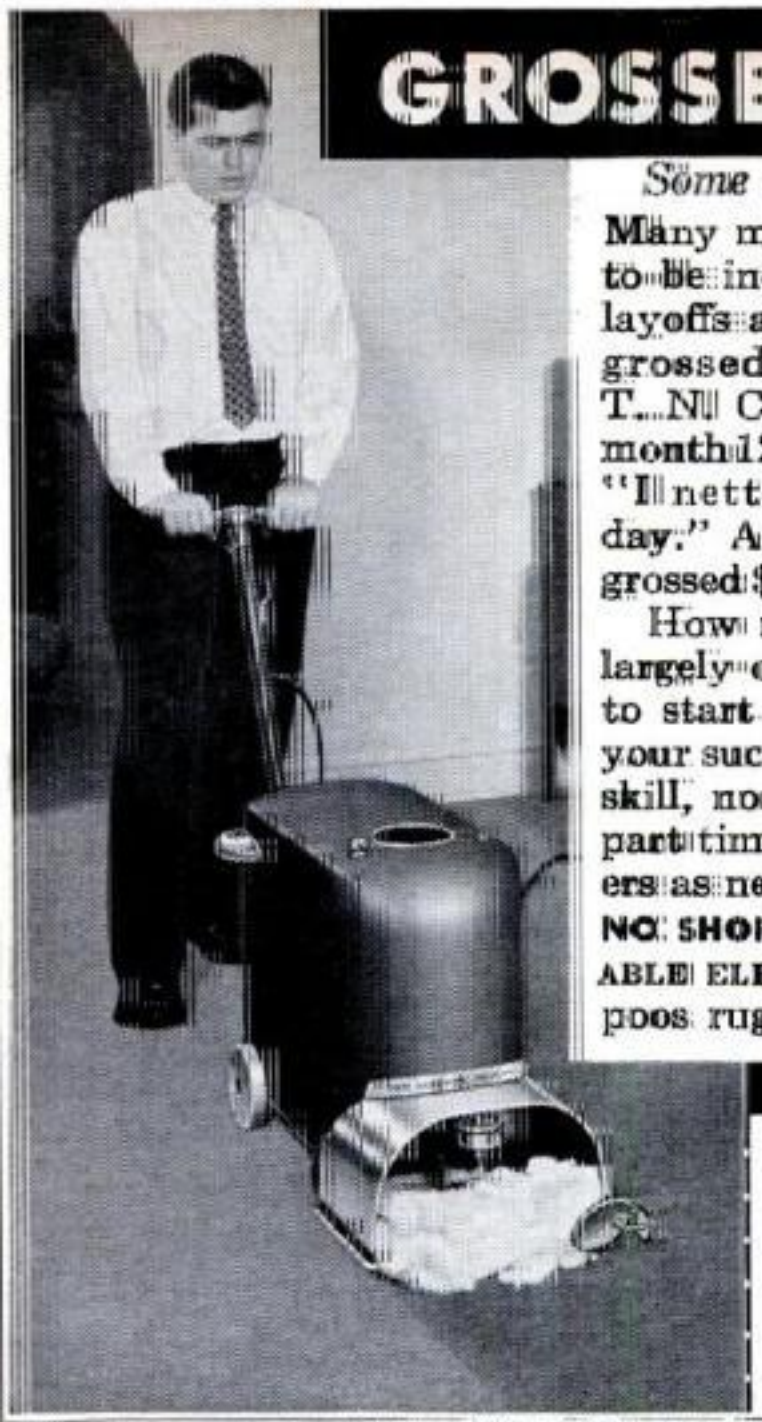

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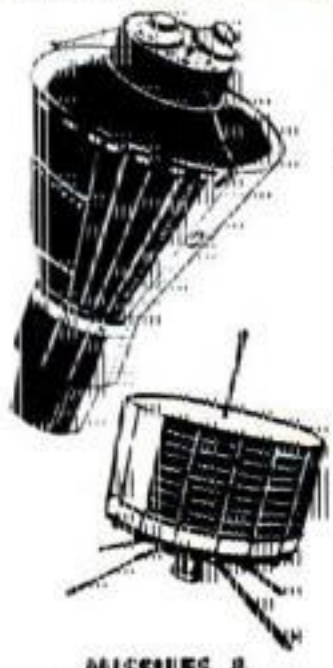

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Detroit report...

FORD IS GOING BACK INTO THE JEEP BUSINESS, but this time it will be basically a civilian vehicle. To be announced this spring, it will look like International Harvester's successful Scout. Wheelbase will be around 90 inches, ground clearance will be high, and four-wheel drive will be among the many options. The base engine will be one of the Falcon sixes, shoehorned into a notched firewall, with the compact yet muscular 289 V-8 (of Mustang fame) an optional easy fit for those who wish to haul trailers or run drag races up and down dry stream beds. There will be a pickup and a closed-body version with back seats. Best bet among rumored names: Colt.

FRONT VENT WINDOWS ARE ON THE WAY OUT--no more cranky cranks and whistling cracks--if stylists prevail over tradition-conscious management. The vent window is considered an eyesore by stylists who could design "cleaner" bodies if they didn't have to provide for it. Its ventilating function will be taken over by cowl inlets and air extractors as on the '65 Ford Galaxie LTD. Look for one-piece front-door glass on several makes by '67.

RADIO ANTENNAS ARE ON THE CLEANUP LIST, TOO--stylists would like to get them out of sight. One GM division is busy perfecting a windshield trim molding that will double in brass (chrome-plated) as the antenna. Another strong possibility, which works even better, is an insulated trunk lid that picks up signals through paint.

SOMETHING NEW FOR STATION-WAGON BUYERS: Before the year is out, Ford should introduce a two-way rear door, designed to hinge at the side for standard doorlike operation, or hinge at the bottom and work as a tailgate. A single handle selects the hinge you want. The door-gate is spring-balanced and works easily either way.

LOOK FOR SOME "SPECIALS" AMONG CERTAIN '67 MODELS --particularly Thunderbird, Buick, and Cadillac. Front drives are under study by all three, and the two GM divisions plus Pontiac are said to be planning distinctively different sporty models.

COMING UP: THE MUSTANG GRAND SPORT. With Mustang's sales curve soaring since introduction of the 2-plus-2 fastback last fall, Ford management is planning to give it another shot in the arm by bringing out a Mustang Grand Sport in the spring. Features are reported to include independent rear suspension, four-wheel disk brakes, and a hotter engine.

Jim Whipple

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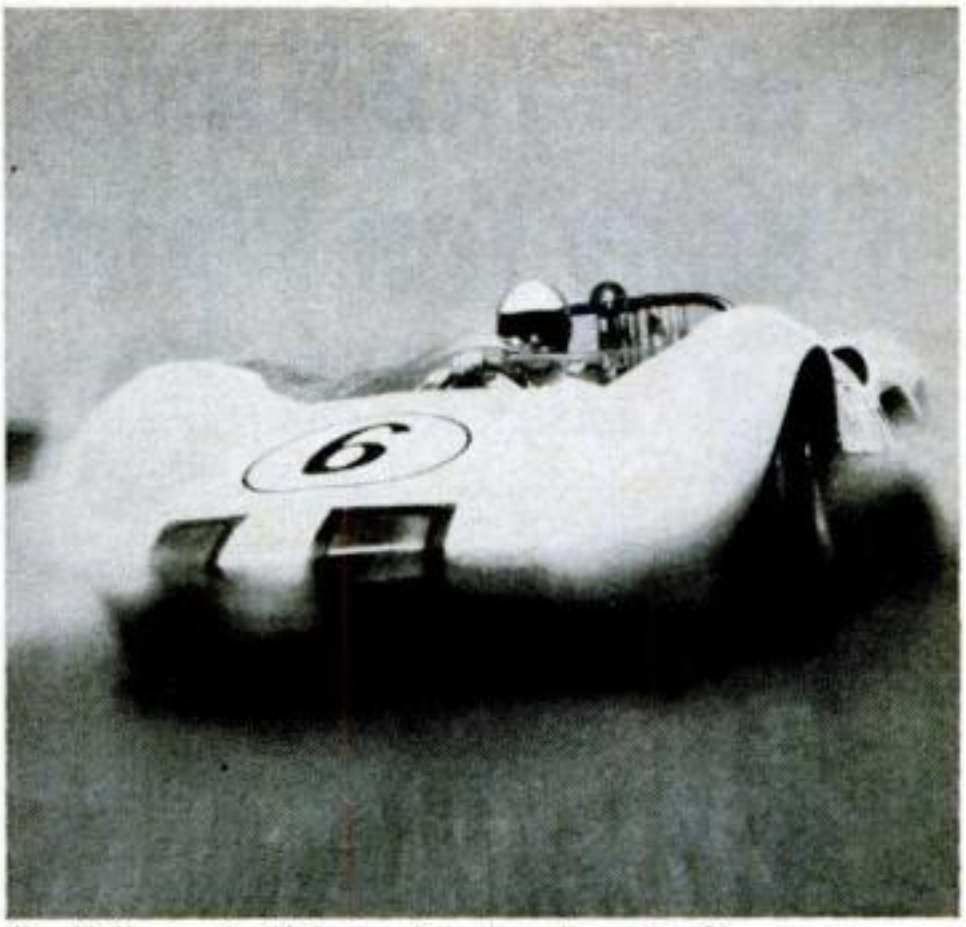
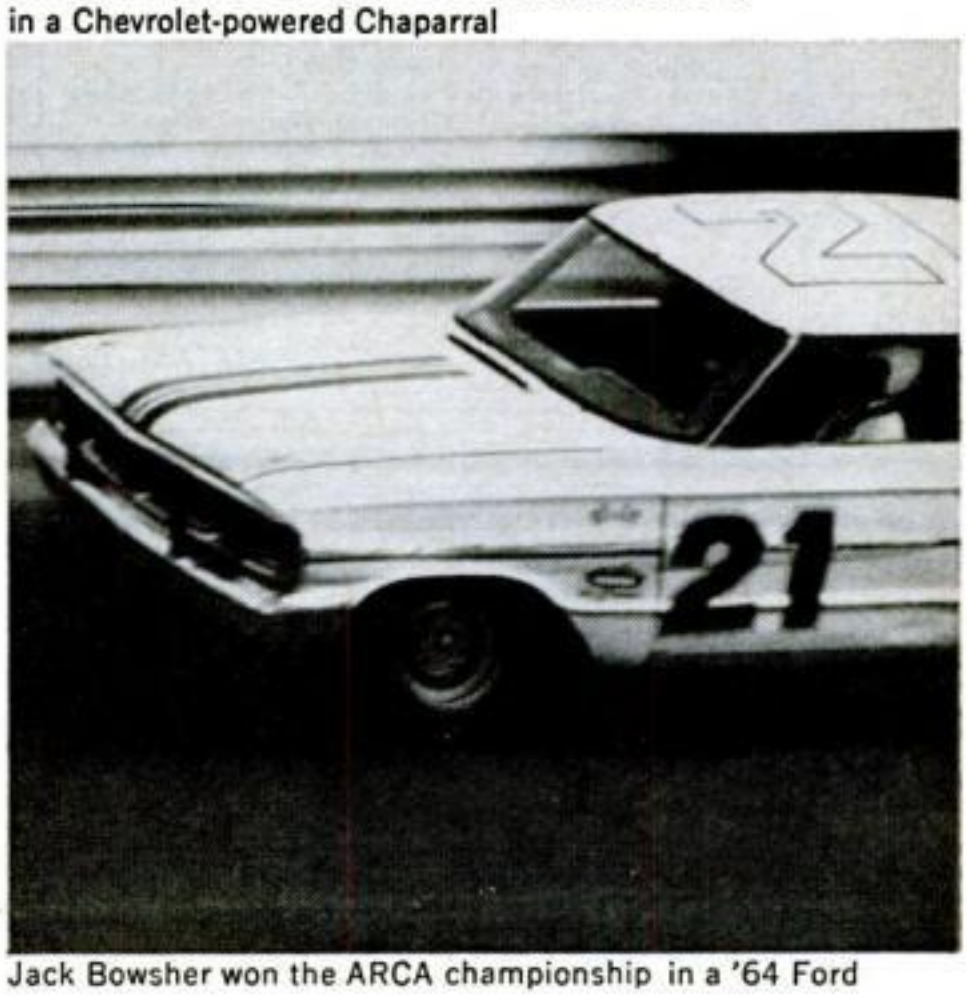
A. J. Foyt won the Indianapolis "500" and the USAC championship with an Offenhauser



Jim Hall won the U.S. Road Racing championship in a Chevrolet-powered Chaparral

Richard Petty won the NASCAR championship in a '64 Plymouth



Jack Bowsher won the ARCA championship in a '64 Ford

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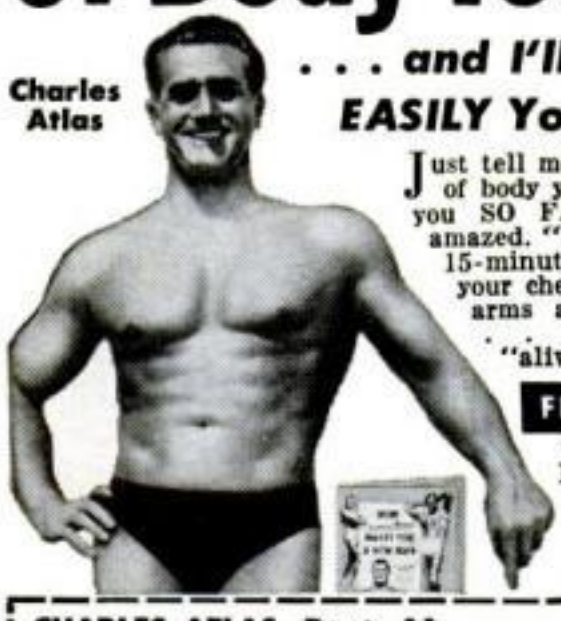

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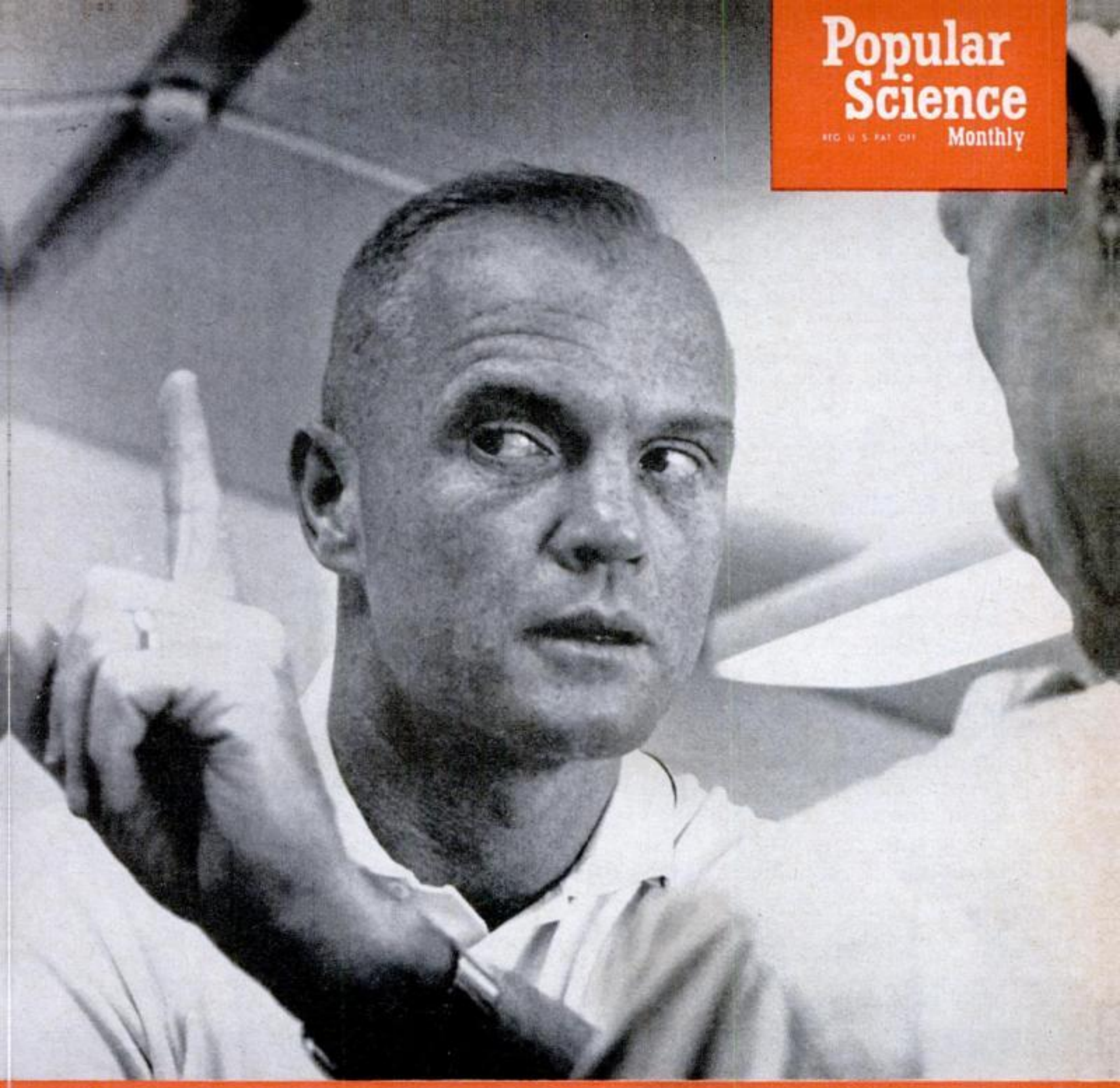

Lt. Col. John Glenn gets physical examination after orbiting the earth three times.

Was John Glenn Injured in Space?

That bathroom fall and lingering ear trouble of the first American to orbit the earth raise challenging medical questions about man in space

The slip that changed John Glenn's life

John Glenn was the picture of a robust American when he got up on the morning of Feb. 26, 1964. Although he had announced he was through with space exploration, he was set to embark on another risky enterprise—politics. He appeared to stand an excellent chance of becoming a United States Senator in his first try for office. Then an earthbound little slip suddenly changed it all:

Finished shaving, Glenn tried to close the cabinet, but the sliding doors wouldn't budge.

He removed one of the mirrored panels to determine what caused it to stick in the track.

By Herbert Shuldiner

LAST February 26, Marine Lt. Col. John H. Glenn, America's first orbiting spaceman, slipped in his bathroom and suffered a serious injury to his inner ear. It happened almost two years to the day after his dramatic feat made him the Lindbergh of our era.

Glenn's illness gains significance from the overwhelming Democratic Party landslide in the last elections. He was thought a good bet to win the Democratic nomination for Senator from Ohio, but was forced out of the primary by his disability. His incumbent rival was swept into the office Glenn might well have assumed this month.

Slippery question. Since Glenn's fall, queries have cropped up in the press and in conversations all over the country: Was there a connection between Glenn's orbital flight, or the training preceding it, and the ailment that made him a temporary invalid and forced him to cut short his political career?

These conjectures increased when it was revealed that Glenn's fellow astro-

Before his space flight, Glenn's inner ear got frequent checks, including this examination in an inner-ear testing chamber at the Pensacola (Fla.) Naval Air School of Medicine.

Prelaunch medical countdown required doctor to run cool water into the semicircular canals of Glenn's inner ear and measure the effect on his eyes for check on balance mechanism.

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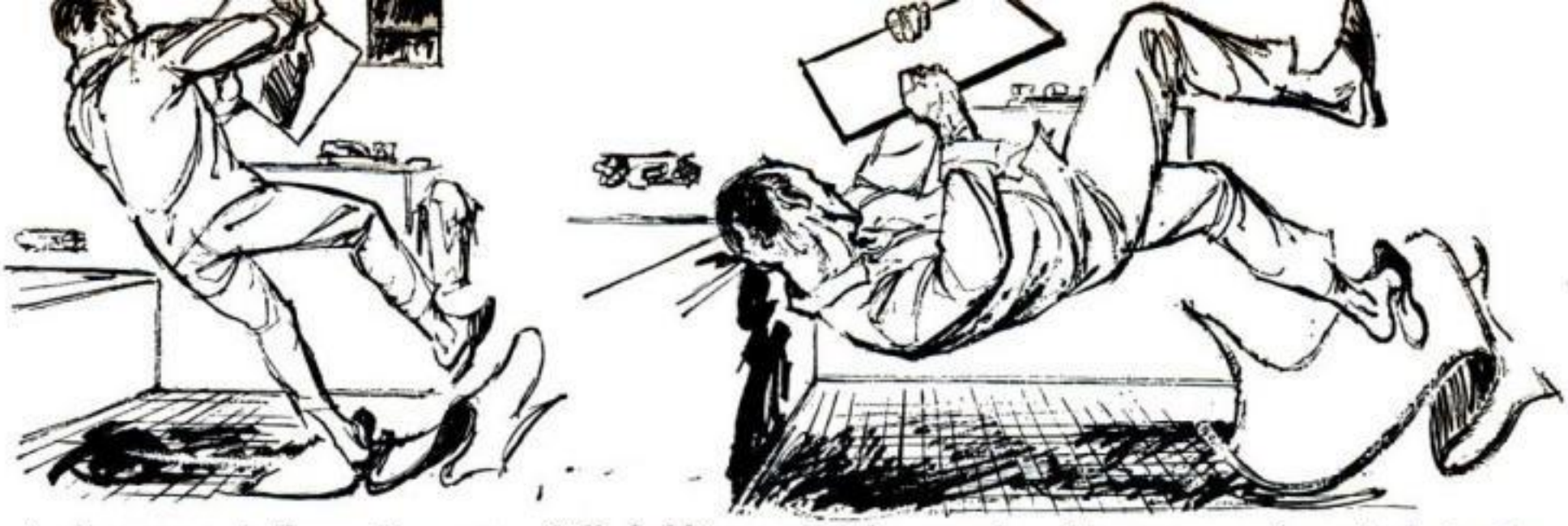


As it came out, the scatter rug under him slipped on the tiles. Glenn began to spin in.

Still holding onto the panel, Glenn landed hard on the edge of the tub. The mirror flew from his grasp and crashed to the floor, the pieces cutting his face and hands severely.

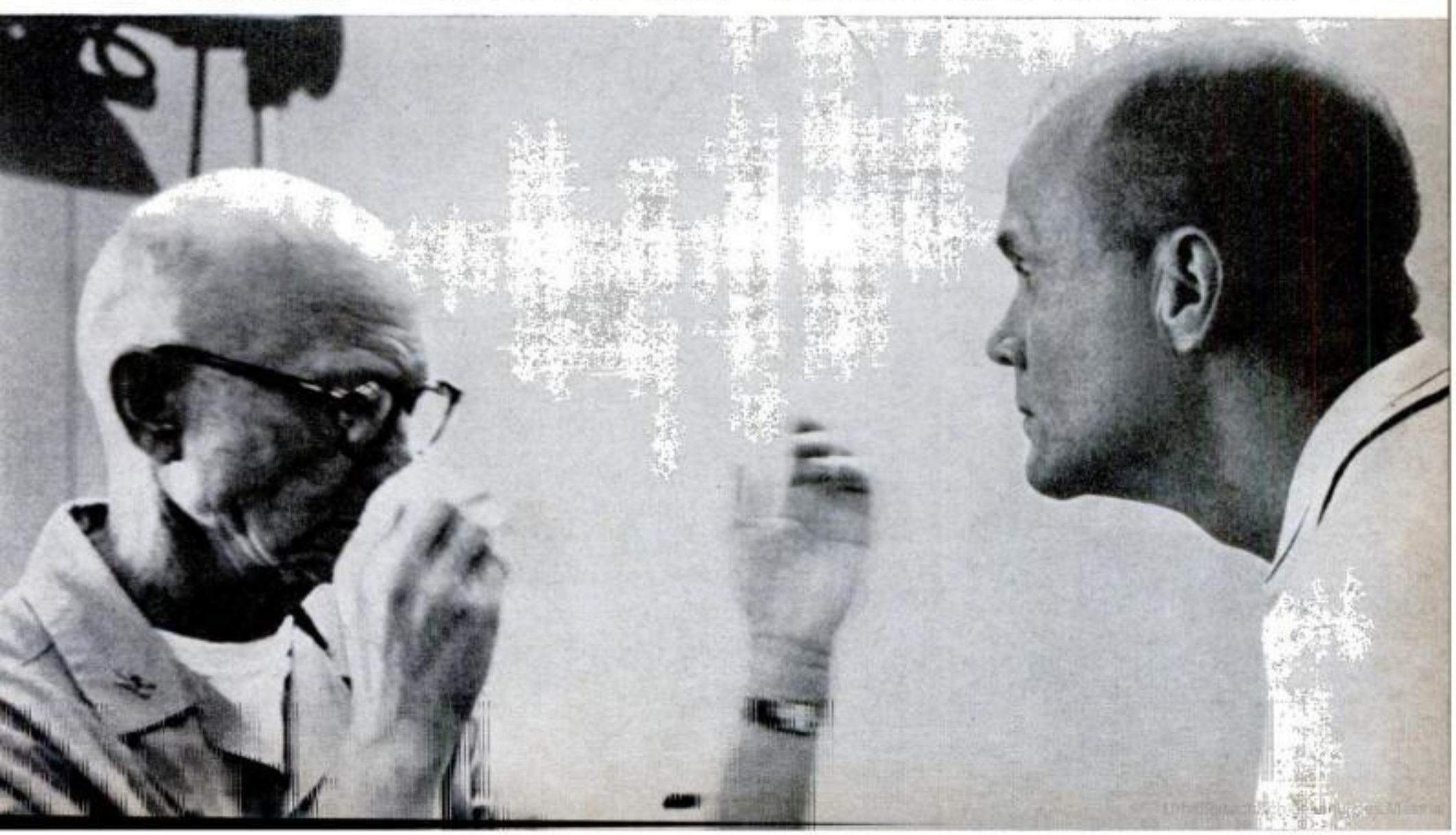
naut, Cmdr. Alan B. Shepard, suffered from inner-ear damage in July, 1963—a little over two years after his 1961 suborbital space flight. And reports that similar symptoms afflicted Soviet spaceman Gherman Titov during and after his 17-orbit flight in 1961 added to speculation on whether space flights have some mysterious effect on man's inner ear.

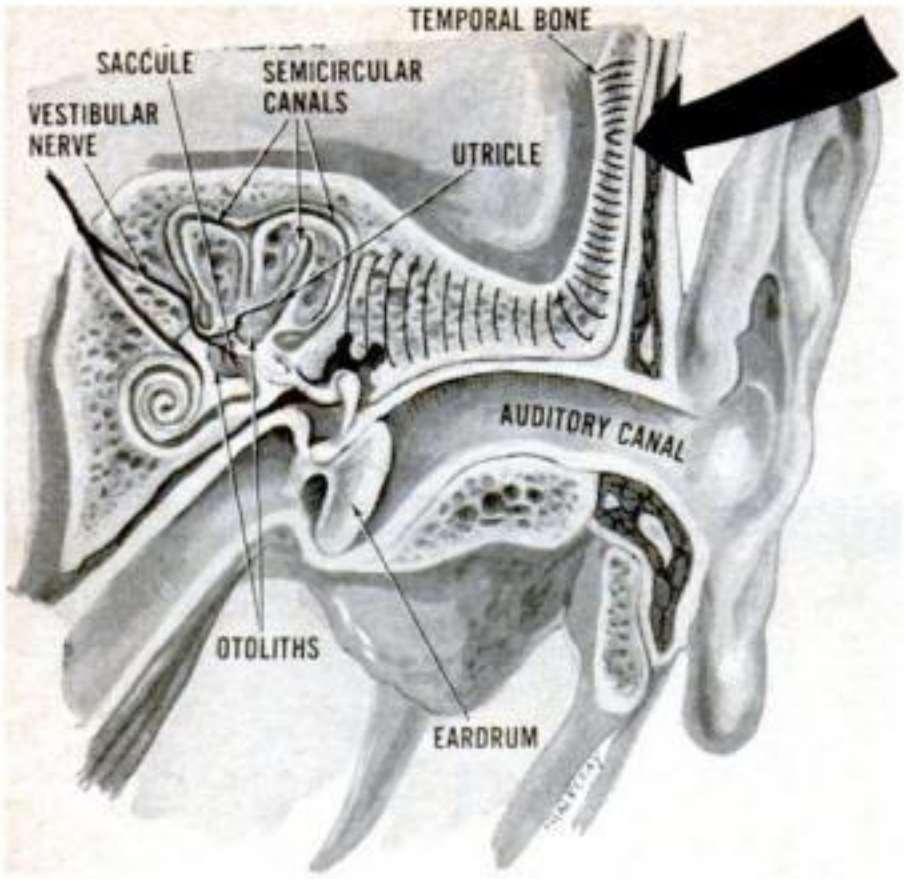
I was assigned by POPULAR SCIENCE to find the answer to this puzzling question. I interviewed doctors who treated the astronauts, as well as other space-medicine experts from coast to coast. One of them, a visiting scientist from Italy, stated that he believes the inner ear may be the most serious handicap to man's efforts to explore outer space.

Investigations by Soviet space scientists lend weight to this conclusion. Prof. Oleg Gazenko, a leading Russian space doctor, told an international symposium on aerospace medicine in San Antonio, Tex., last November, that six of the nine Soviet cosmonauts have suffered motion sickness stemming from inner-ear disturbances. Intensive study on the effects of space flight on the inner ear is needed, he said.

CONTINUED

After pickup from his space capsule, Glenn was flown to Grand Turk Island in the Bahamas for a postflight medical checkup. Dr. Ashton Graybiel of the USN School of Aviation Medicine conducted part of the test, which revealed no injuries to the flier. Glenn reported that the feeling of weightlessness not only didn't harm him, but was quite pleasant.





The astronaut's injury occurred just above and behind Glenn's left ear (arrow). Shock wave traveled through temporal bone to semicircular canals and the saccule and utricle. The otoliths are the white granules in saccule and utricle.

The story. I explored Glenn's problem with his close friend and collaborator, Otis Wiese. Wiese, editorial director of World Book Encyclopedia Science Service, will soon publish John Glenn's book *P.S. I Listened to Your Heartbeat.* Here, as Glenn told it to Wiese, is exactly what happened:

"I had just finished shaving and replaced my razor in the medicine chest. When I tried to slide the mirror doors shut, they wouldn't close. I realized the track was jammed. So I decided to remove one of the panels and see what the trouble was.

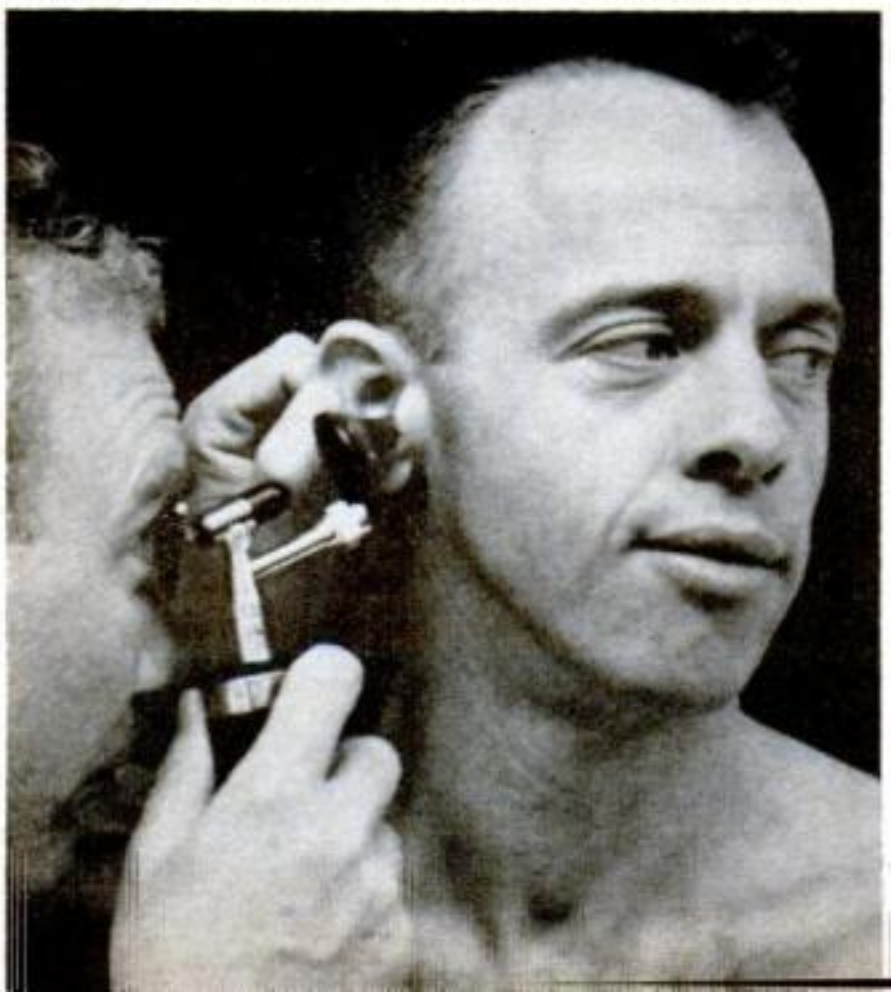
"I was standing on a scatter rug that covered the tile floor as I grabbed the panel with both hands and removed it. Suddenly I realized I was slipping, but I tried to hold on to the mirror and keep it from breaking, rather than let go and use one of my hands to break my fall. I began to spin in as I fell, and my head banged down hard on the edge of the tub. I hit just above and behind the left ear.

"The mirror flew from my grip and crashed to the floor. Flying pieces of glass cut my hands and face. I didn't pass out, but I was in a state of shock."

Glenn told Wiese that the inner-ear symptoms didn't appear immediately. The astronaut was put to bed right after his accident and said he didn't feel any dizziness until he tried to get up.

Then any sudden movement of his head brought dizziness and nausea. It lasted for over six months. Glenn lost 20 pounds and grew pale and weak before he started recovering. Would the fall and subsequent injury have occurred to a man who had not been in space? Did Glenn get dizzy as a result of his fall—or did dizziness *cause* the fall that made him a temporary invalid?

First Mercury pilot—Alan Shepard—got rigid prelaunch checkup just prior to his historic flight from Cape on May 5, 1961. His inner ear, then normal, has given trouble since.



A "typical case." Capt. Richard H. Mattson, a member of the team of doctors who treated Glenn at Wilford Hall AF Hospital, in San Antonio, told me Glenn's dizziness was a post-traumatic vertigo caused when Glenn hit his head "with a significant force." The injury produced "a typical case of labyrinthitis"—an injury of the inner ear, the delicate mechanism that controls the body's balance and equilibrium.

The inner ear and the labyrinth are located under the area where Glenn was stunned. The shock, says Dr. Mattson, did temporary damage to the area and had nothing to do with Glenn's experiences in space—"as far as we know."

Shepard was also afflicted by labyrinthitis, but his illness was said to have been caused by a virus infection. The two

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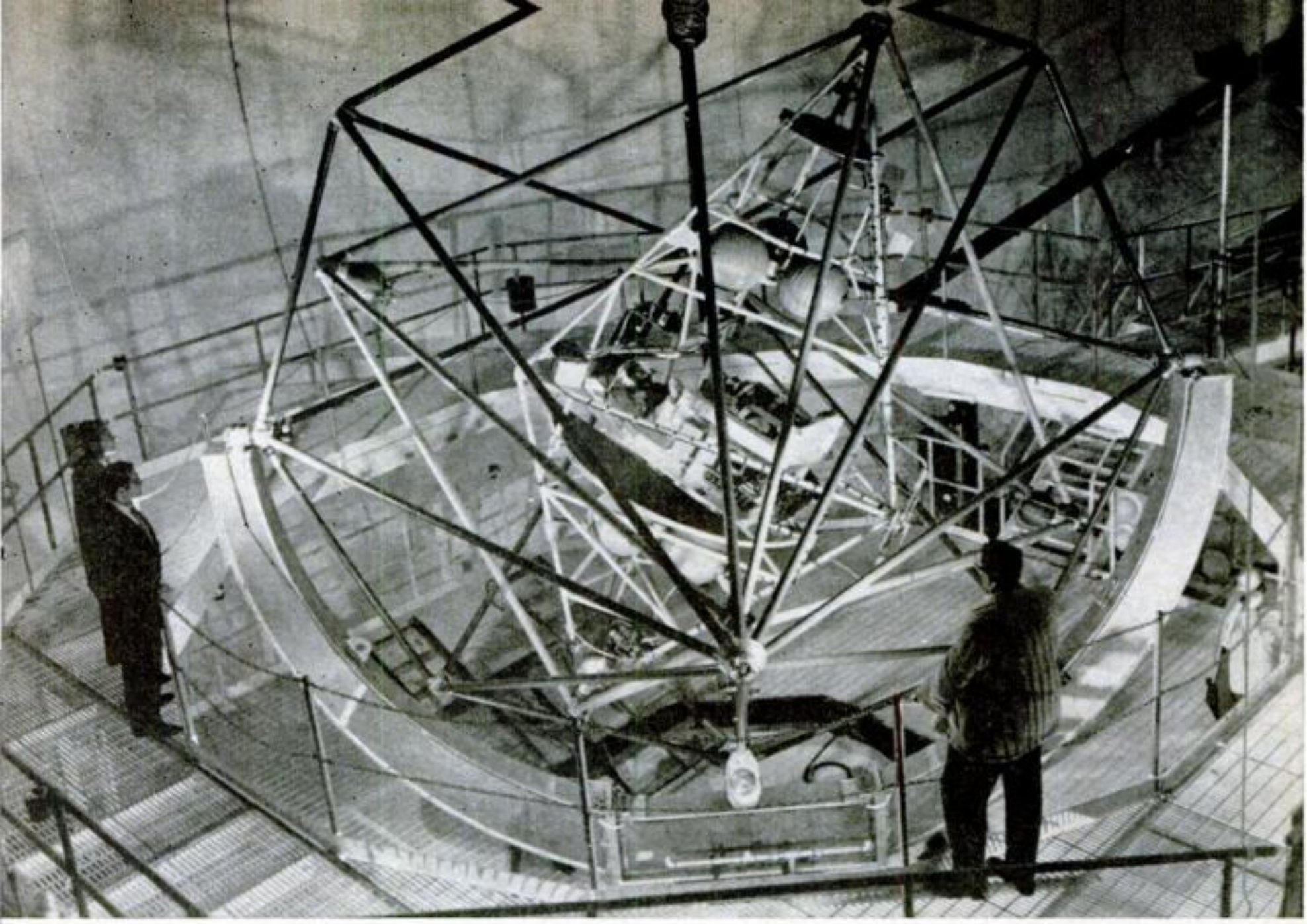

Most intolerable to astronauts in training was this device—the MASTIF chair—at the Lewis Research Center, Cleveland. Its yawing, pitching, and rolling motions made them sick.

cases are unrelated, Dr. Mattson says.

In an exclusive interview at the Manned Space Flight Center in Houston, Shepard told me that neither his nor Glenn's inner-ear problems resulted from space flights or from their training.

Shepard readily admits that, at times, astronauts became ill during training. All of them got sick after repeated runs on the MASTIF (Multiple Axis Space Test Inertia Facility).

This device subjected the astronauts to simulated yawing, pitching, and rolling maneuvers, sometimes simultaneously. It gave the astronauts airsickness symptoms, but, says Shepard, "It only proves that you can make any man sick if you spin him long enough."

Neither training nor actual space flights, Shepard maintains, inflicted inner-ear injuries on the astronauts, Glenn and himself included. He doesn't believe that the inner ear is a serious obstacle to space flight.

But Capt. Ashton Graybiel, director of research at the Navy's School of Aviation Medicine, Pensacola, Fla., told the aerospace-medicine symposium that while inner-ear problems have not troubled our astronauts so far, the organ may still cause trouble on future flights.

This view was also expressed by other experts, some of whom insist that it is not possible to say with certainty that our astronauts have suffered no inner-ear injuries.

Dr. Bernard Wagner, chairman of the New York Medical College Department of Pathology, and a member of the AF Scientific Advisory Board, stoutly maintains that it's not possible to rule out any connection between space flights and inner-ear injuries: "You can't be that dogmatic. There is no sensitive way of picking up minimal inner-ear damage."

It is significant, Dr. Wagner notes, that the Russians, who have had the most experience with weightlessness, have placed such great emphasis upon inner-

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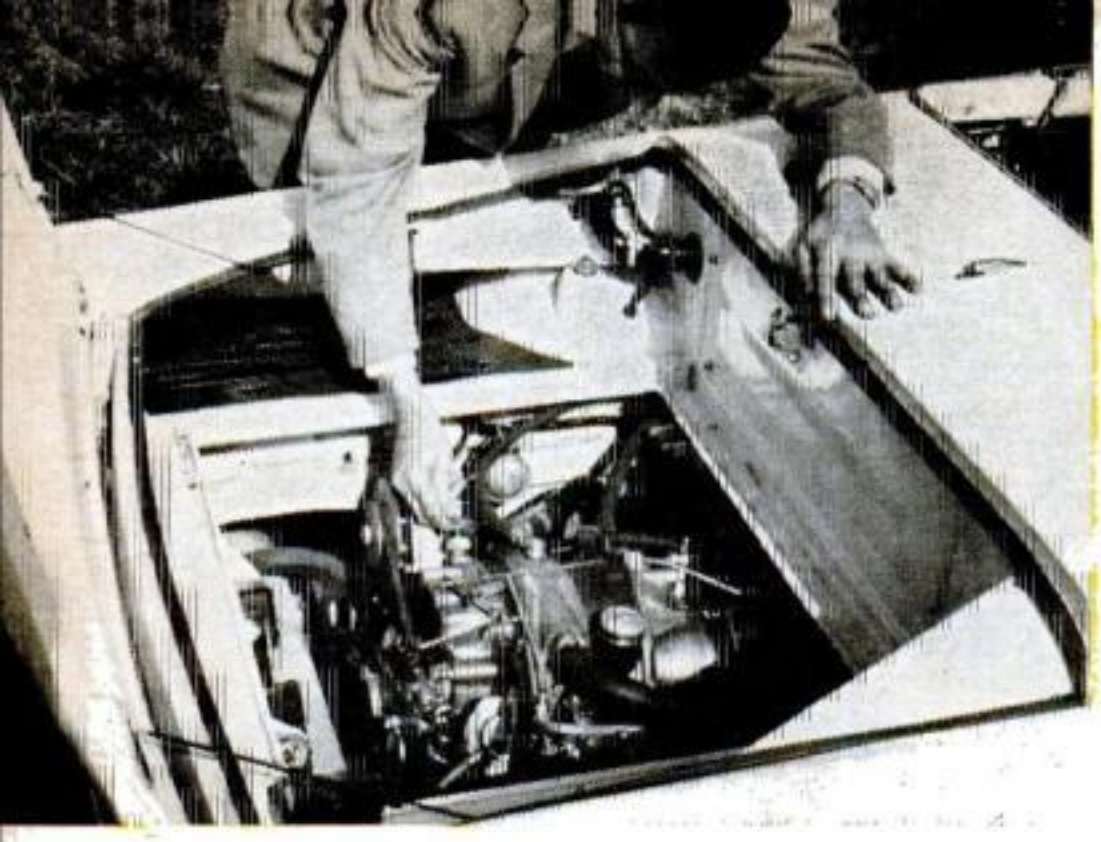


When we first reported the amazing Wankel, it was a laboratory curiosity, scoffed at by some engineers. Now a PS Editor, Dave Scott (above), tells you what it's like to drive a production car powered by this unique rotary engine

POWER WITHOUT

AT LONG last, that controversial Wankel engine, with no pistons and no cylinders, is in production and actually powering automobiles. I've driven it. It's wonderful. It's weird, too.

This is the engine that drew sly guffaws from official Detroit when POPULAR SCIENCE featured it on the cover in March, 1960. It would never work, they said.

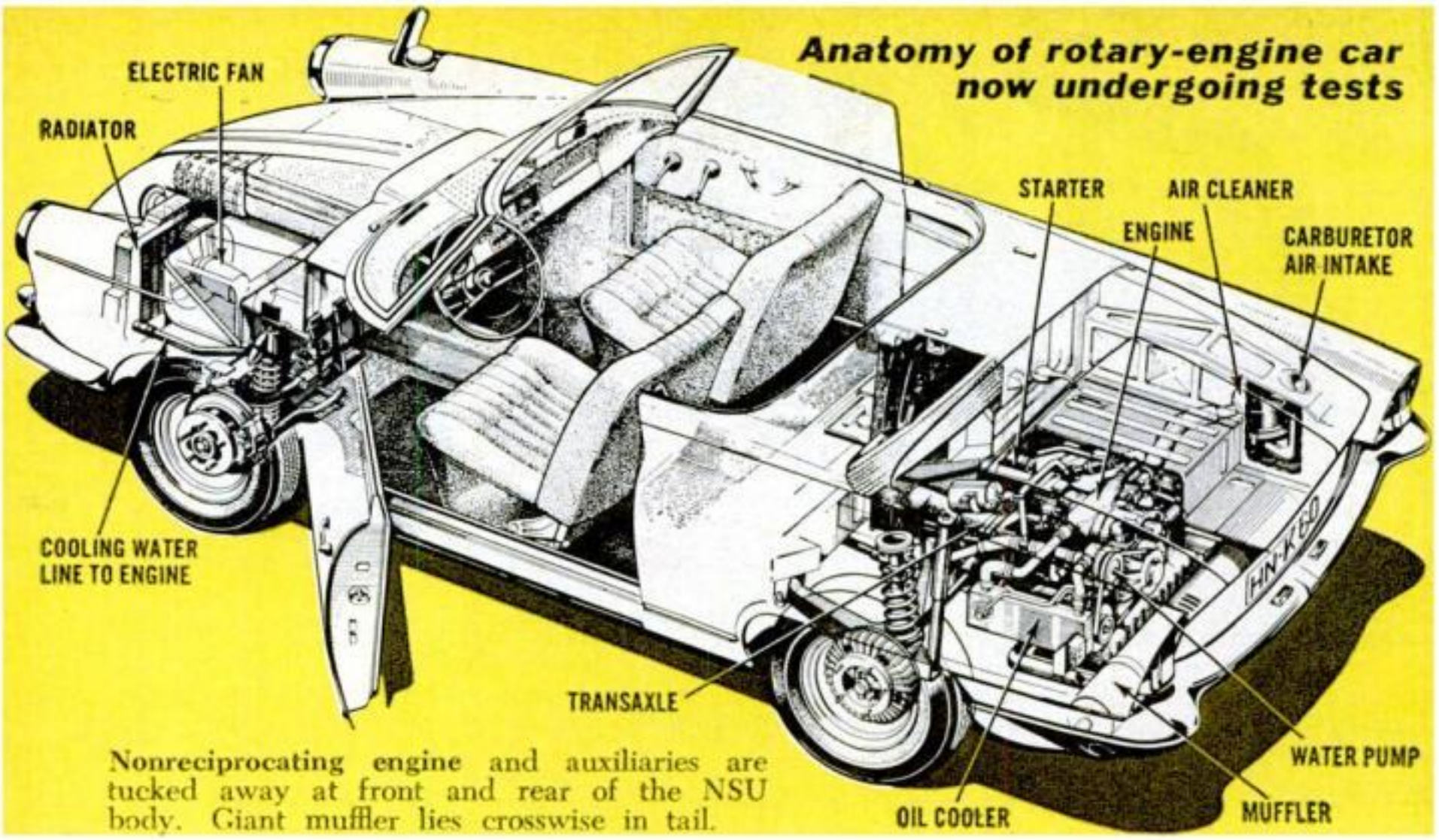
Today Ford is reported to be testing a Wankel in a Galaxie, and both General Motors and Chrysler have Wankels on test stands.

A Japanese company, Toyo Goygo, has been licensed to produce it. So has Italy's Alfa Romeo; and France's Citroen has a joint arrangement with NSU, the German company that originated the Wankel, to develop it further.

At the Goodwood race track in England, I tried out an early production model of the little NSU Spyder roadster with the unique rotary engine in the tail.

It goes, but good, when you lay on revs that would make an ordinary piston engine split its gut. But it's a creep if

At England's Goodwood track Wankel Spyder accelerated best, 0-60 m.p.h., in second gear.



Nonreciprocating engine and auxiliaries are tucked away at front and rear of the NSU body. Giant muffler lies crosswise in tail.

PISTONS

By David Scott *PS European Editor*

you try to drive it as you would a normal power plant.

You twist the starter key and a gentle whirring comes from behind. Then comes a slow rhythmic beat, like a four-stroke lawn mower lazing over. The engine sounded to me as if it was idling at a couple of hundred revs, but the tachometer showed 1,000 r.p.m.

I dabbed the throttle and the needle whipped around to 6,000 at the end of the red "danger" zone and bounced quivering off the pin. The exhaust note rose in a swift glissando to a muffled purr. With my foot lifted, the note almost instantly returned to a hushed pattering.

This Wankel obeyed commands like Aladdin's genie. And there wasn't a trace of vibration. "This'll be fun," I thought. A German technician leaned over the cockpit. "Don't worry about the 6,000 revs," he said. "Do whatever you want."

I slipped the gear lever into first, squeezed the throttle a bit, and let out the clutch. But we only crept forward. Flooring the pedal didn't add much urge.

"Start with more revs," the factory representative called after me. I stopped and repeated the drill, warily spinning the engine to about 2,500 r.p.m. before easing the clutch out. This time we glided boldly into action.

Giving more gas, I centered the car in the long straight in front of the pits. Getaway was silky. It could have been an electric motor. Before I had time to think about shifting, the tach needle was hammering against the pin. The revs died in a flash as I cut the gas to shift, then shot up again to drive through second.

Confidence grew with further upshifts through the four-speed box, and I felt my way around my first lap of the circuit. By trial and error I learned that the rev-happy Wankel truly delivers the goods when in full flight, but loses heart

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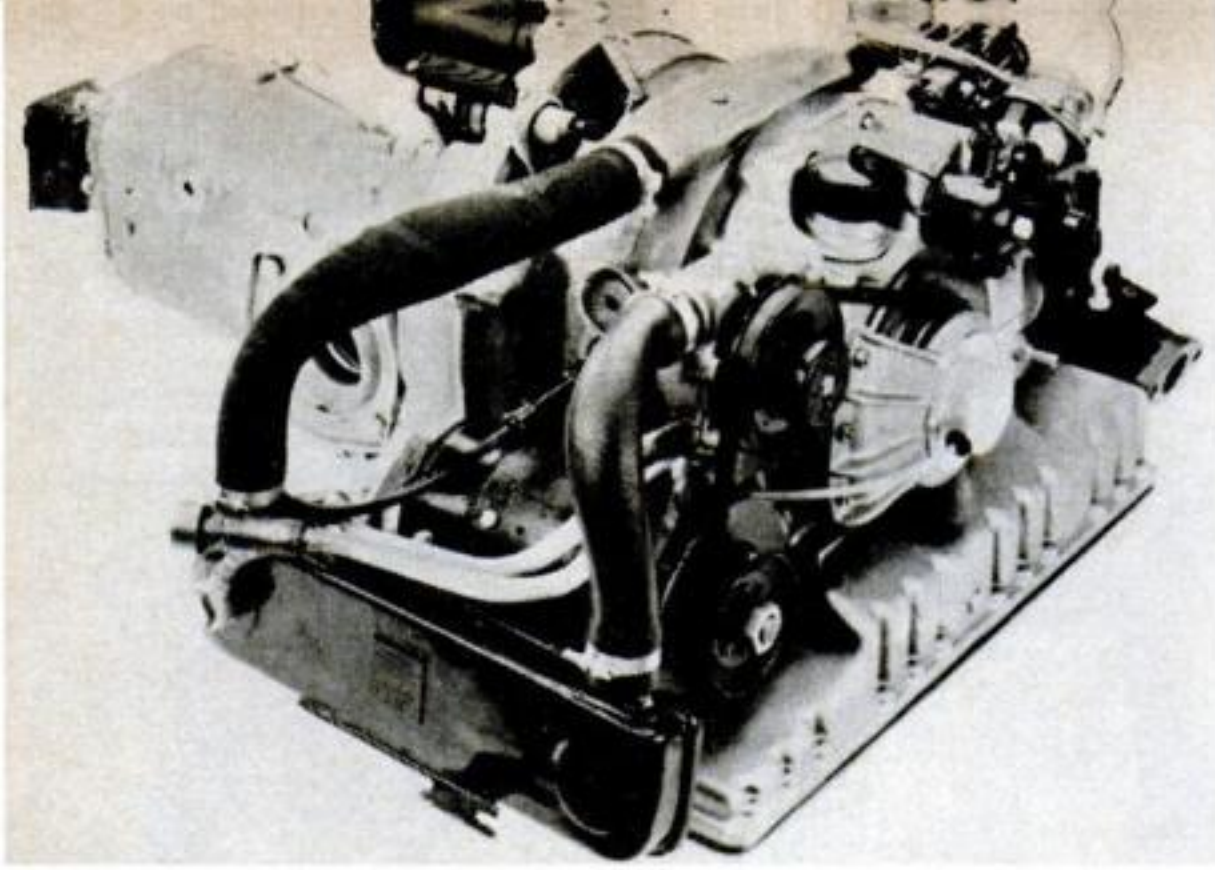

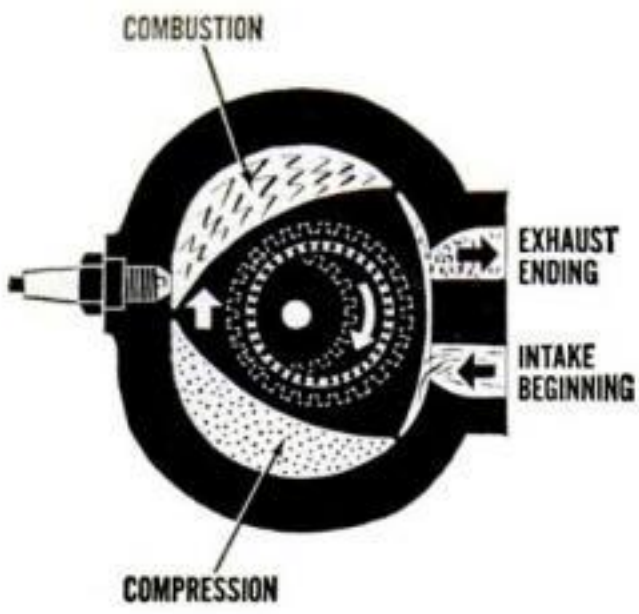

The engine itself: Heat exchanger (left in photo) cools lubricating oil pumped through rotor where it leaks to friction surfaces. Drawings cover one-third of an engine rotation. Apexes of rotor scrape single, odd-shaped chamber as they revolve, forming three pockets of constantly changing volume—performing same function as pistons in conventional four-cycle

at the bottom end of the tachometer.

Below 2,500 r.p.m. there is little pulling power, and the muscles only come in at around 4,500. For peak performance you have to use the gearbox often and wisely, with an eye on the tach. You can't play this one by ear, at least not without practice.

I found I could push the car up to 45 m.p.h. in first gear, which equals close to 11,000 r.p.m. Useful power drops off at about 7,000, but even at these peak revs under load there are no complaining noises, since, with only two moving parts, the Wankel has no valves to clatter and bounce.

I made my best 0-60-m.p.h. acceleration time, 14 seconds flat, by staying in second, shifting out of first at 30 m.p.h. When I went into third at around 50 m.p.h., the time rose to 15.8 seconds.

Third is pretty flexible, though, and will be the best gear for town driving and country-lane touring. Between 3,000 and 7,000 revs, pickup is brisk, with the real punch coming in at 4,500. Fourth is overdrive, and strictly a turnpike gear. You can coax a shade over 90 m.p.h. out of it, but at 25 it just doesn't want to go.

Don't expect much engine braking.

Noise level is moderate throughout the engine's range. Surprisingly, the subdued whine is less noticeable as speed rises, especially with the top down. Mostly there's just a soothing hum. And vibration doesn't exist in this balanced, nonreciprocating machine.

NSU had to wrestle with a pack of problems before daring to offer the Wankel in a car. Gas-sealing was the main one, and this was licked by compromising with the potential capabilities of the design.

There are problems to be solved. The conception is ingenious, but the engineering bugbear was to hold the fantastic pressures of compressed and burning gases in the variable-size chambers. Apex seals were the biggest difficulty, and early experiments with different materials and shapes failed because either their life was too short or bore wear was too great.

The present solution is self-lubricating carbon strips seated in grooves in the rotor tips and pressed by springs against the chrome-plated bore. Similar to brushes in an electric motor but made of special hard carbon, these are expected to last for 50,000 or more miles at moderate engine speeds, and a new set can be installed in an hour. The wear rate is calculated to extend the life of the block, which is much more costly to replace.

Other snags have crept in. While the basic engine is extremely compact and light, the present layout calls for special

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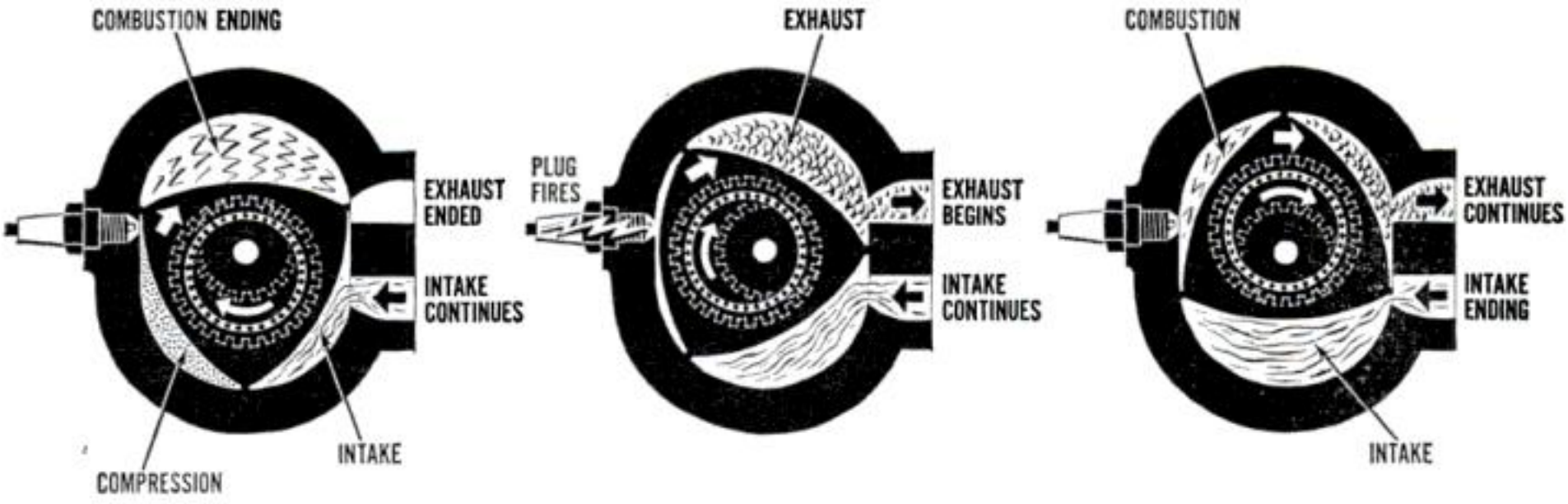
three power impulses per revolution



engine. Ports substitute for poppet valves. In this latest version, roller bearings carry load between shaft and rotor. Each pocket cycles completely for every engine revolution, providing three "power strokes." Eccentric drives coaxial output shaft at three times rotor speed. Center fixed gear meshing with internal gear in rotor keeps rotor in time.

auxiliaries that boost the weight and cost of the car. A muffler the size of a giant golf bag is needed to sweeten the exhaust note without causing power-robbing back pressure.

Then there are two cooling systems: The rotor is internally cooled by pressurized oil, requiring a water-cooled heat exchanger. And because the water radiator for the stator block is in the front of the car, there has to be an electric fan and long large-bore pipes under the floor to connect with the tail-end engine.

As a result the Spyder weighs 1,543 pounds, over 300 more than the NSU Sport-Prinz which has a similar body and an air-cooled piston engine of about the same displacement. This hefty weight penalty takes some of the edge off the Wankel's promise.

Then there's the cost. The Spyder is tagged at nearly $3,000 in the United States. That's about twice the price of imports of comparable size, looks, and speed. The price, no doubt, will drop in time.

Little servicing. A small compensation is that the engine runs happily on cheap 85-octane gas. And you never have to change the oil—only add a quart every 700 miles or so, which is consumed by lubricating the rotor in the total-loss system. Little servicing should be needed—there are so few wearing parts.

So far NSU has made about 1,000 Spyders, and plans only 5,000 in 1965.

Next in the cards is a twin-rotor unit for a roomy family sedan with performance in the two-liter (120-cu. in.) class. This might have a body built by Citroen. Such an engine would be little bigger than the 1,500-cc. job and have more pep at low revs. It is also rumored that Mercedes-Benz is working on a three-rotor machine with fuel injection. The German spin-mill may yet revolutionize the auto industry. ■■

FACTS ON THE NSU WANKEL SPYDER

Model: two-seat roadster.

Engine: A rotor revolving in a chamber to create three combustion pockets of 500 cc. each (91.5 cu. in. in all). Output shaft turns at three times rotor speed. Hp., 64 @ 5,000 r.p.m.; max. torque, 54.25 lb.-ft. @ 3,000 r.p.m.; compression ratio, 8.6:1.

Transmission: 4-speed, synchromesh; ratios, 3.08, 1.77, 1.17, .85; reverse, 3.43.

Axle ratio: 4.43:1. **Turning circle:** 31.2 ft.

Outside dimensions: wheelbase, 79.5 in.; overall length, 141 in.; width, 59.8 in.; height (top up), 49.6 in. **Curb weight:** 1,543 lb.

Acceleration (seconds): 0-60 m.p.h., 14; 40-60, 8.2; 50-70, 9.8. **Top speed:** 92 m.p.h.

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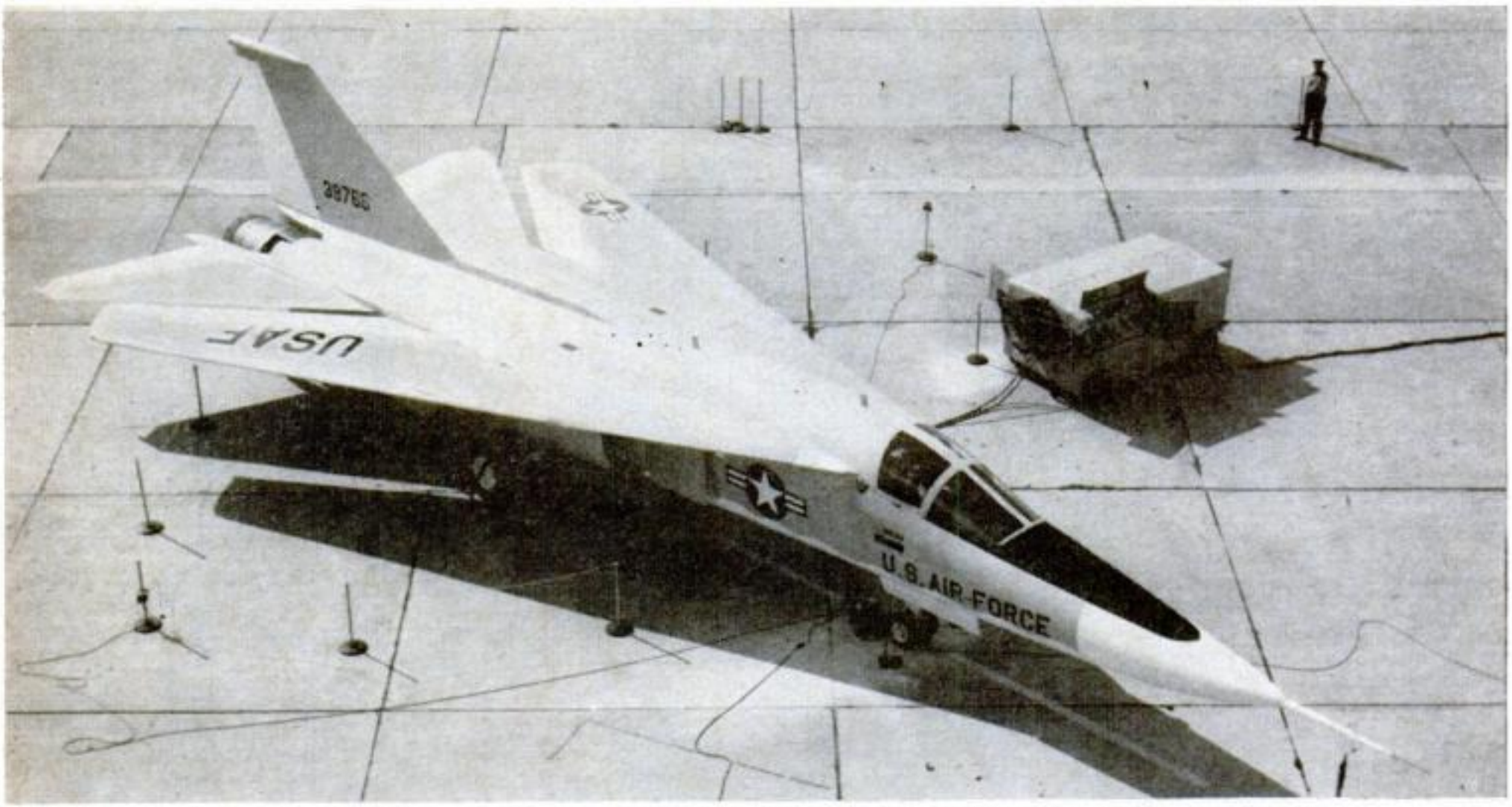

Wings swept back, doublesonic plane is so fast it can pass 16-inch shells in flight . . .

PS reporter previews the F-111

When Defense Secretary McNamara's "flying switchblade," the silk-slick package of sound and fury known as the F-111, finally goes on the surplus market, I am going down there with my long white beard and my life savings and buy one. Why?

This is an old gentleman's plane. Where else can I get a flying machine that can take off from and land on Joe Schwanda's airport at Hackettstown, N.J.—yet, when I lay its ears back, can fly alongside a 16-inch shell so I can read its serial number, then motor on past. I can leave New Jersey at breakfast and reach Los Angeles *before* breakfast. I can fly to Ulan Bator in Outer Mongolia without refueling. If I

Chief Test Pilot Dick Johnson, left, ushers POPULAR SCIENCE *writer Frank Harvey into brand-new F-111 on roll-out day. Plane's top speed: Mach 2.5. Range: transoceanic without refueling. Landing speed: 100 m.p.h. Armament: rockets, napalm, H-bombs, conventional bombs. It has firepower of five World War II Flying Fortresses.*

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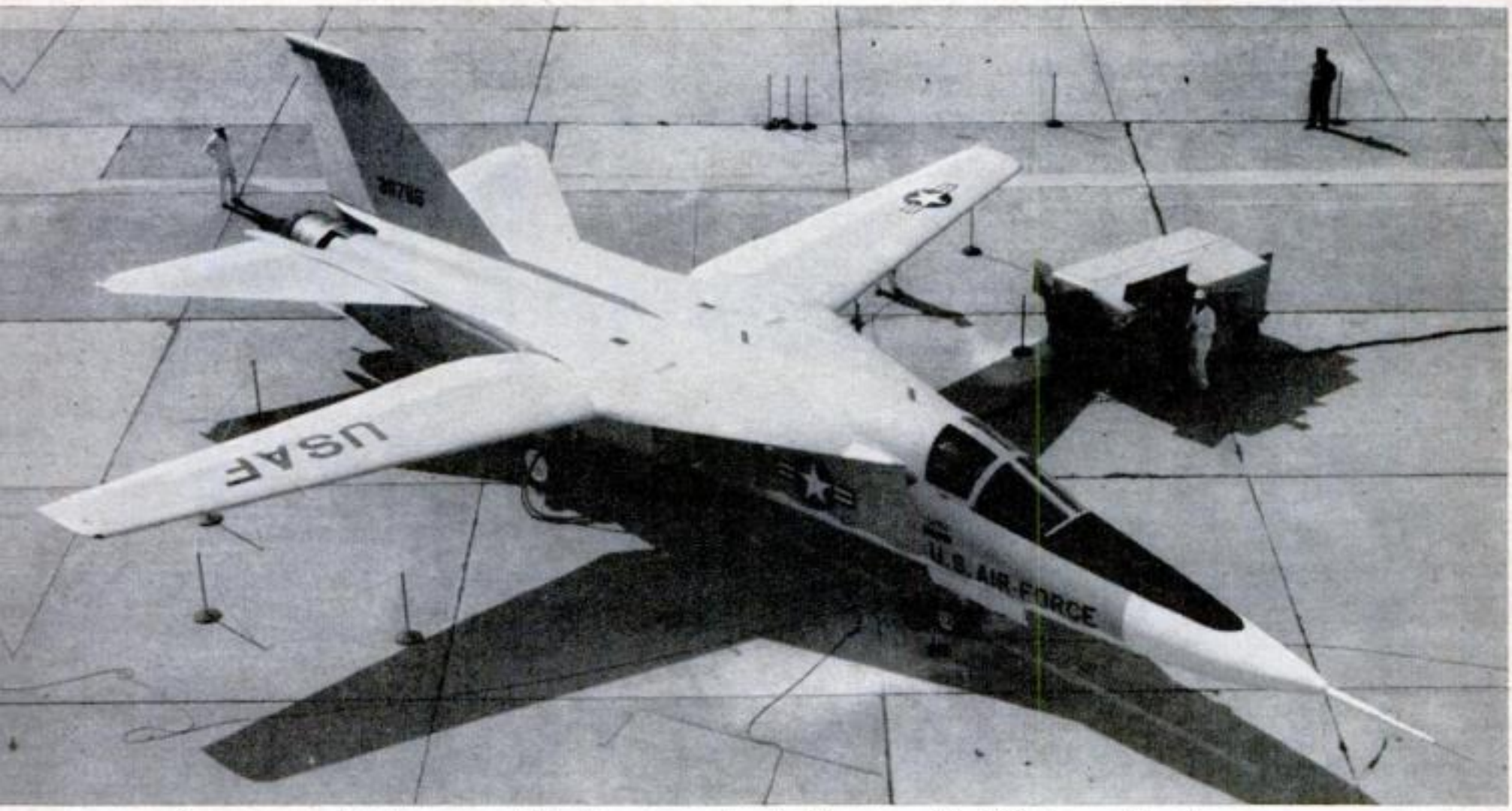
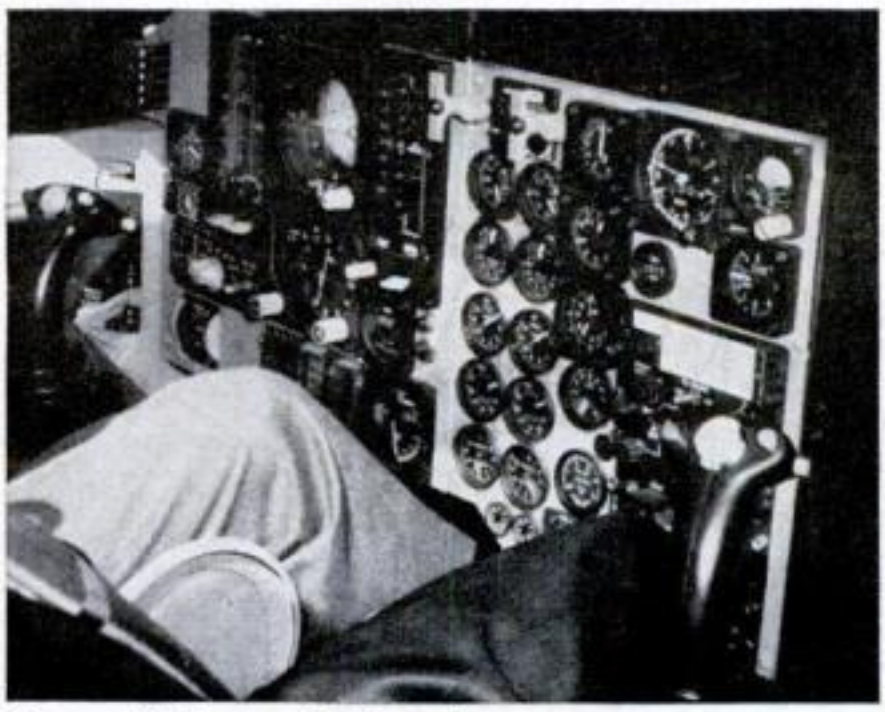


or, wings spread at press of button, can land like an old DC-3 on short runways or carriers.

should have to bail out (although I can't see *both* engines failing), its capsule has floats, two-way radio, and rocket assist for a gentle landing.

Incidentally, this is a military plane. It lands on aircraft carriers as well as on land bases, can wipe out a whole city at a blow, defend the U.S. against bombers. The USAF and Navy are so delighted with it they are ordering 1,700. Australia, too, is ordering without even knowing if the thing can fly.—*Frank Harvey.*



Snug little cockpit where two-man crew sits side by side is simpler than some of World War II's fighters. Pilot and weaponeer eject in same capsule.

Jack-of-all-trades plane can meet enemy bombers with guided rockets 2,000 miles away, substitute for SAC B-52s with huge H-bombs, land on any flat, hard pasture.

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America's leading rocket expert takes you behind the scenes to explain what happens when a big space vehicle like the Saturn is launched

WHY AND HOW OF THE COUNTDOWN

By Dr. Wernher von Braun

Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala.

TO THE average TV viewer, the countdown of a big rocket is a curious space-age fad. A set of numbers flicking on the screen and a studiously unemotional voice team up in the strange ritual of counting seconds backward. Obviously invented by a showman, its sole purpose seems to be to build up tension and excitement for the audience. As the clock at last strikes zero, the show culminates in the fiery spectacle of the launch.

Probably few laymen know the real purpose of a countdown, or just how one is carried out. Actually a countdown is a carefully developed procedure of preparation for launch. Because of its tremendous importance to the success of a rocket firing, its details deserve to be better understood.

What countdowns are for. The purpose of a countdown is to:

- Assure maximum safety for flight crews (if any), ground crews, and equipment, while the vehicle is prepared for flight.
- Avoid wearing out critical flight or ground equipment by activating it too long before launch.
- Enable the launch director to launch at an exact instant—corresponding, say, to a favorable position of celestial objects, or to requirements for orbital rendezvous.
- Synchronize launch preparations with supporting operations such as the readying of radars and tracking cameras, or the setting up of road blocks near the launch site.

For operational military rockets, the response to a firing order must be quick. Little if any telemetry for collecting data in flight is involved. Such a countdown may take only a few minutes.

But a complex multistage rocket carrying an equally complex spacecraft and highly sensitive research gear, whether unmanned or with a human crew, requires a countdown that may extend over many hours.

In case of trouble. If the countdown goes according to plan, it's pretty rigid, but it offers plenty of flexibility if difficulties arise. Essential to a well-prepared countdown plan is a set, clear-cut procedure for "recycling the count."

Suppose an equipment malfunction occurs, after much of the on-board guidance and radio equipment has been turned on—and an estimated two hours will be required to repair or replace the faulty part. Obviously much of the activated on-board gear should be turned off again. Therefore the countdown—already advanced, say, to T minus 7 minutes—may be cycled back to "T minus 20 and holding." This means that

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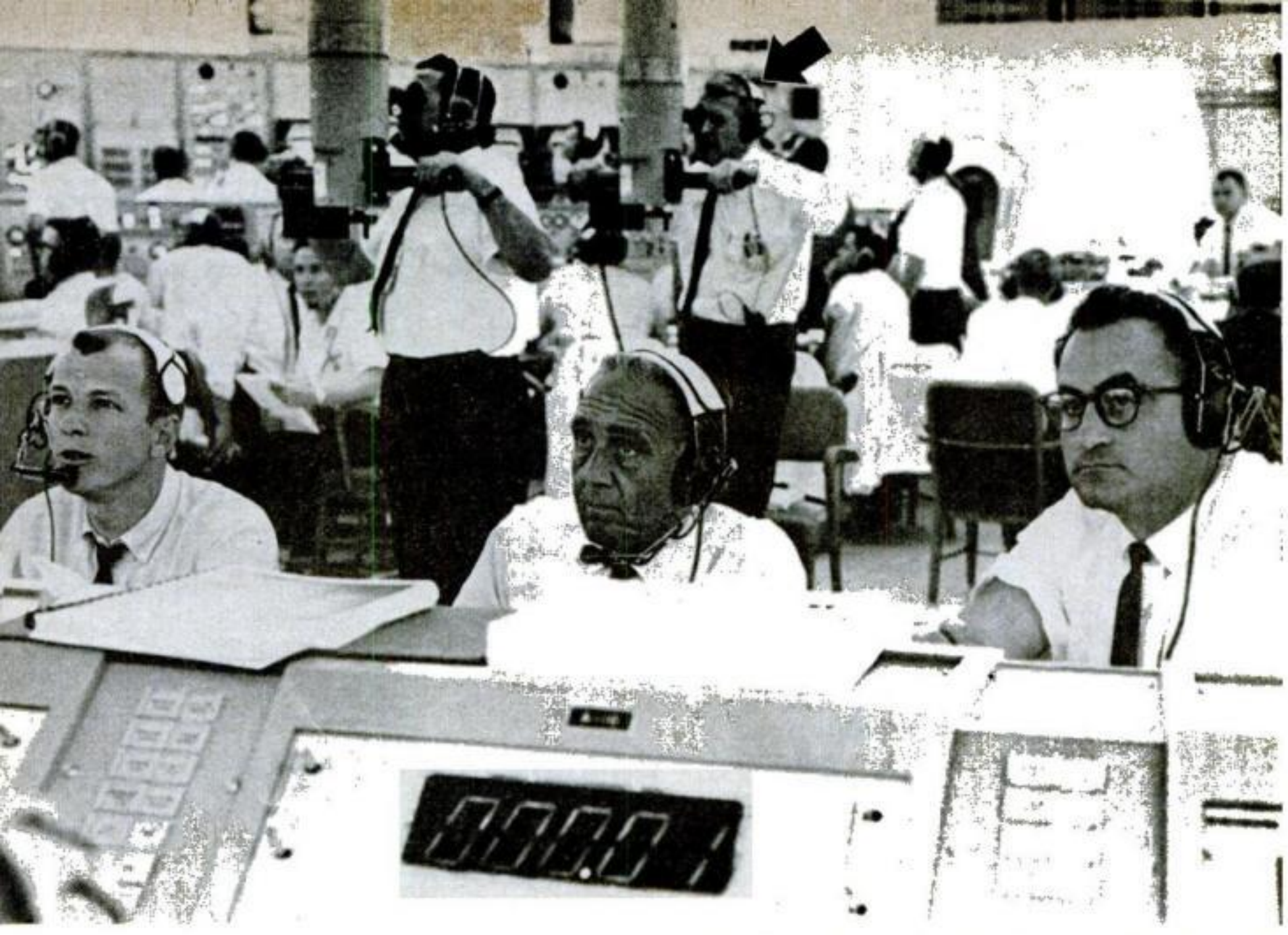

In Cape Kennedy blockhouse, Dr. Kurt H. Debus (lower center) directs countdown for a Saturn launching. Dr. von Braun (arrow) watches at periscope. Black block on control panel (foreground) is official countdown clock.

the count will be resumed at T minus 20 minutes, whenever the repair work has been completed and the replacement part has checked out okay.

But there may be merely a temporary radio interference, clearly traced to a passing aircraft. In this case the count will be held "momentarily." No equipment will be turned off. The count will continue at the clock reading where it was stopped, as soon as the trouble clears up.

A set of emergency procedures, in a well-planned countdown, safeguards flight and ground crews and the space vehicle in the event of any serious malfunction. The proper emergency procedure must vary as the countdown clock ticks along. It undergoes drastic changes as hazardous fuel and oxidizer are pumped into a liquid rocket's tanks; again, as the servicing structure is removed from the space vehicle, and there is no longer access to certain critical stations of the vehicle. A few minutes later, after ground crews have evacuated the launch-pad area, the flight crew monopolizes the launch director's concern for safety of personnel. In case of a dangerous fire in the rocket, for example, the crew of the spacecraft may now fire its escape rocket without endangering the ground crew.

In the final phases of the countdown the text for the emergency procedures, usually printed on every back page of the countdown book, becomes longer than that for the actual launch procedures themselves.

How SA-7 was launched. The Cape procedures for SA-7, our seventh Saturn I rocket, launched last September 18 from the John F. Kennedy Space Center in Florida, illustrate the launch preparations and the countdown of a large rocket still in the developmental stage.

It was at Cape Kennedy that the elements of this two-stage Saturn rocket had first met. The eight-engine first stage, assembled and static-tested at NASA's George C. Marshall Space Flight Center, had come to the Cape by barge. The hydrogen-oxygen powered six-engine second stage, static-tested at Sacramento, Calif., by its maker, the Douglas Aircraft Co., had arrived by air. From Marshall, again, had come the "instrument unit," a ring segment carrying all of the rocket's guidance and most of its radio equipment. The "boilerplate Apollo"—

[*Continued on page 178*]

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PS ELECTRONICS

Is Your TV Antenna Out of Date?

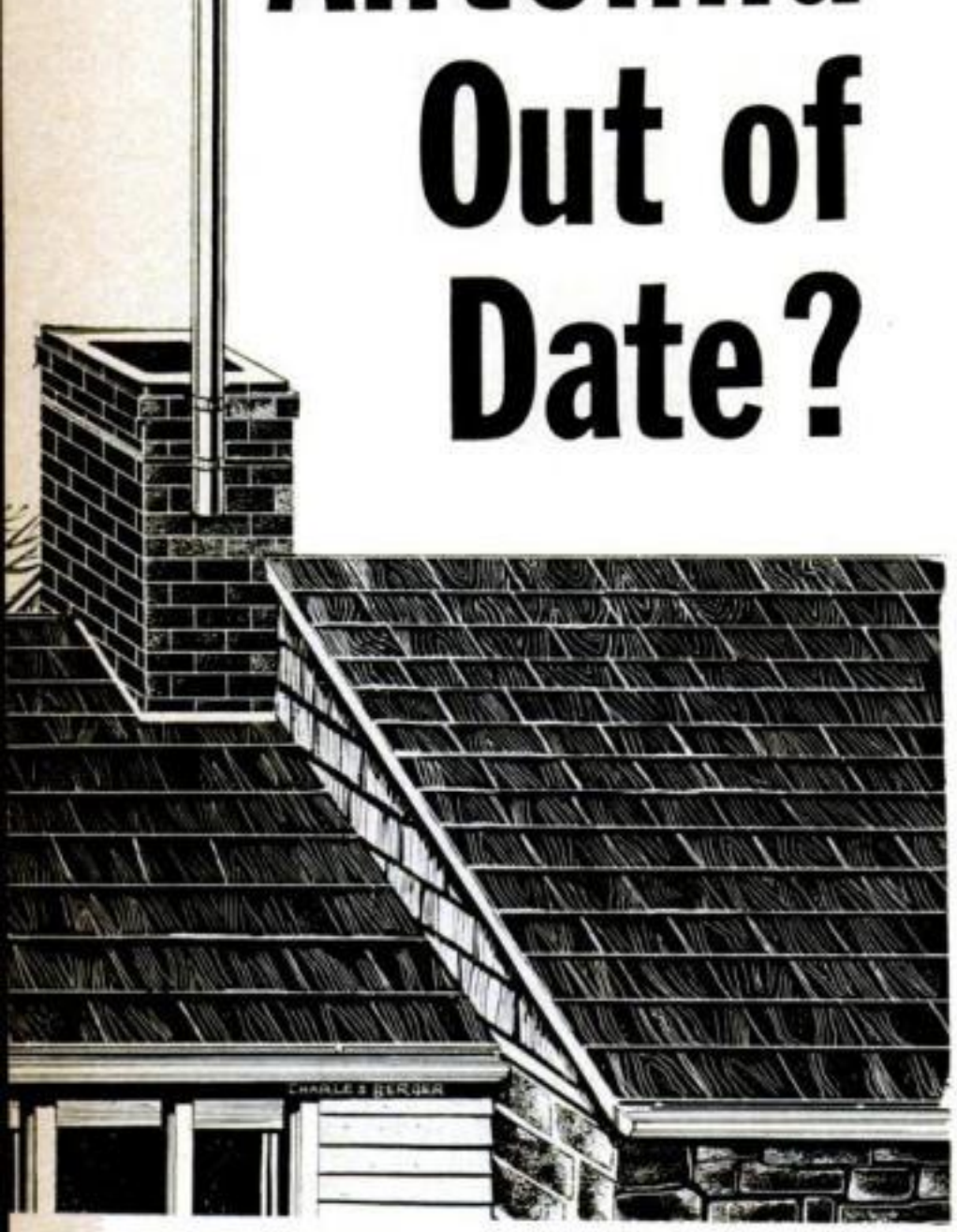
New designs pull in

By Ronald M. Benrey

YOUR TV antenna may be as out of date as a horse and buggy on the Indianapolis Speedway, and the 1965 models now available prove the point.

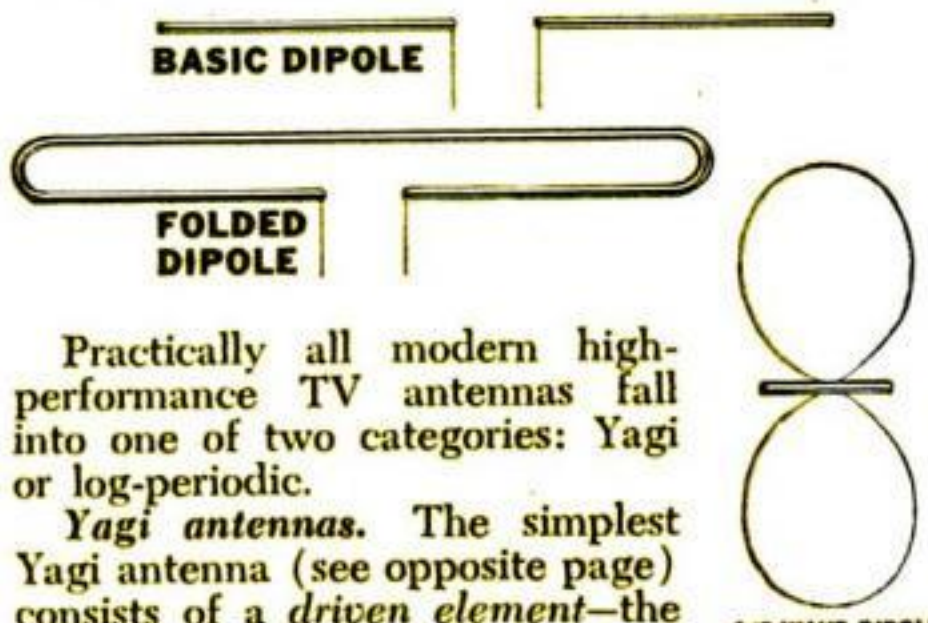
What most TV owners don't know is that there are hundreds of different antennas, each designed for a specific combination of location, terrain, signal strength, and interference.

I've just returned from an extended visit to the research and development laboratories of the major TV antenna manufac-



The Jerrold Paralog is one of the new types of TV antennas you'll be seeing on the horizon.

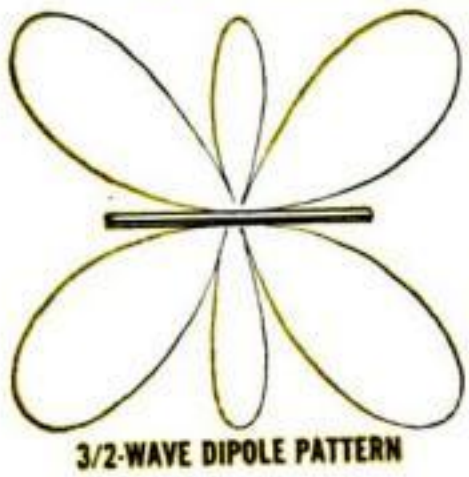
How Modern TV Antennas Work



Practically all modern high-performance TV antennas fall into one of two categories: Yagi or log-periodic.

Yagi antennas. The simplest Yagi antenna (see opposite page) consists of a *driven element*—the active part of the antenna that's connected to the set—and two parasitic elements—the *reflector* and *director*—that are insulated from the driven element, a *half-wave dipole* or a ½-wave dipole bent into a V. *Folded dipoles* are often used because they have a wider receiving bandwidth than basic dipoles. This lets the antenna receive a wider range of signal frequencies.

The parasitic elements increase the antenna's gain by concentrating electromagnetic radiation onto the driven element: The director guides waves back to the driven element, and the reflector bounces forward any waves that get by. The reflector



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far-away stations, chase ghosts, bring in UHF and color

turers. I asked a lot of questions, and got a lot of answers.

- Why the tremendous variety of shapes and sizes?
- How much better are the new rigs?
- What about color TV and UHF?
- Why does an antenna wear out?
- What's the story on the new log-periodic antenna? On antennas with built-in boosters?

Some of the answers I got surprised me: The log periodic is a direct descendant of a telemetering antenna developed for a space satellite.

Some answers didn't: With 60,000,000 sets in the country, and widely varying conditions for reception, it's wise to let your local serviceman select the best type of antenna for your location.

An antenna isn't an accessory—it's a full-time working part of your TV. The antenna absorbs the electromagnetic waves broadcast by the TV stations in your area, and generates tiny signal currents that it force-feeds to your set's tuner. How well an antenna does its job is measured by two variables:

Gain—a measure of how sensitive an an-

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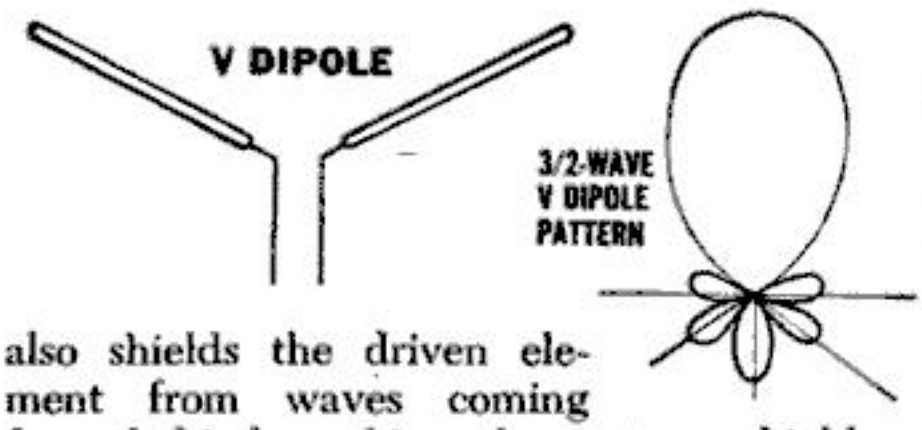
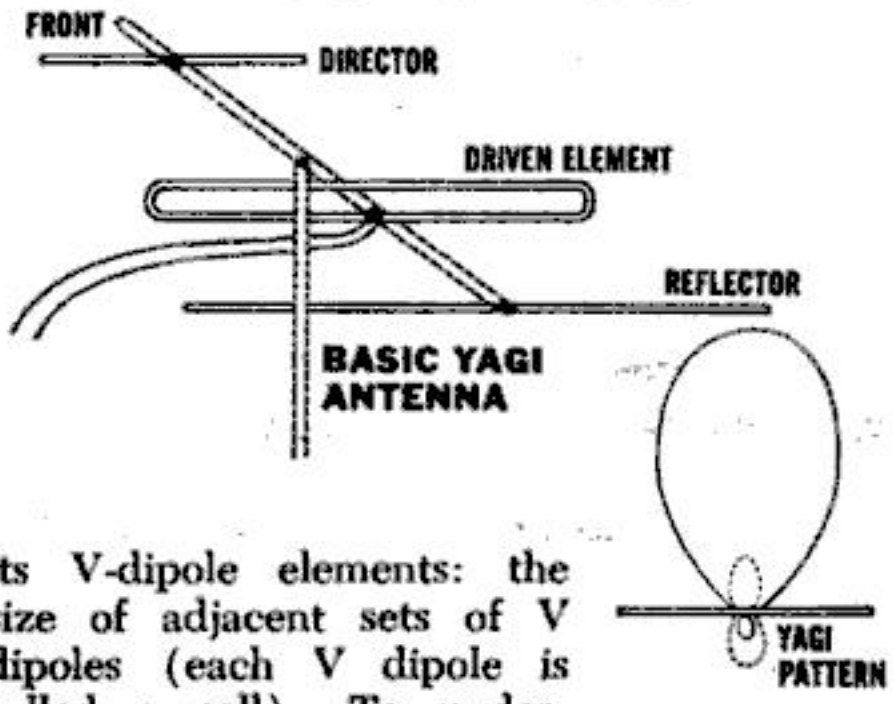


also shields the driven element from waves coming from behind, making the antenna highly directional.

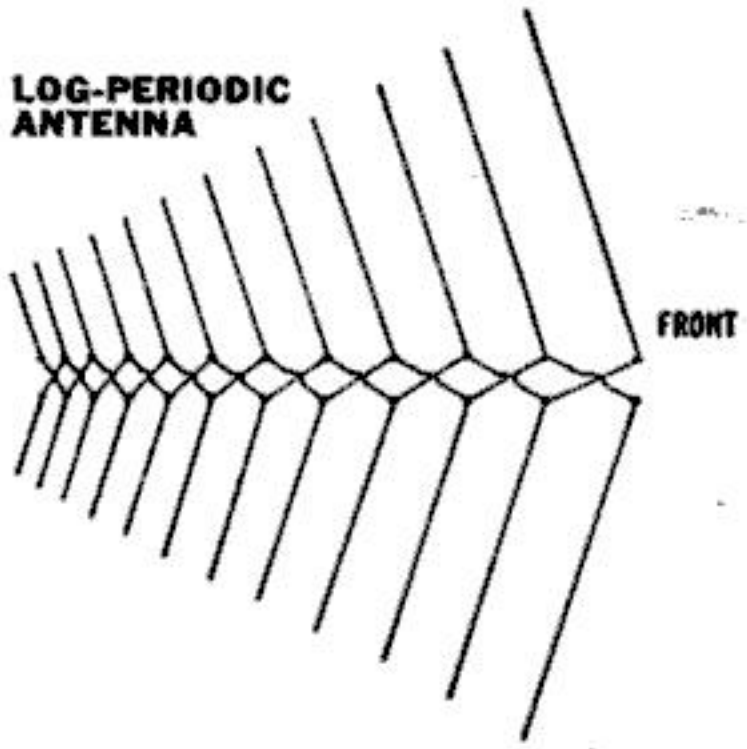
High-performance Yagi antennas use additional director elements to increase sensitivity (gain) and may be equipped with specially designed multiple driven elements to widen the antennas' receiving bandwidth.

Log-periodic. This gets its name from the logarithmic spacing and proportion of



its V-dipole elements: the size of adjacent sets of V dipoles (each V dipole is called a cell). To understand how it works, picture a metal twist-drill gauge: Any particular size drill can fit exactly into only one hole in the gauge—the hole that measures the drill's exact diameter.

In the same way, an electromagnetic wave striking the antenna is absorbed only by two or three adjacent cells—the active region, made up of V dipoles whose overall length is closest to being ½ the wave's wavelength.



The location of the active region on the antenna is analogous to the location of the correct hole on the drill gauge. As the frequency of the incoming wave changes, different cells absorb it, and the position of the active region shifts along the antenna. The crossed harness connecting adjacent cells introduces a phase shift that cancels signals arriving from the rear, making the antenna highly directional.

An advantage of the log-periodic design is that a single antenna can be designed to receive UHF in addition to VHF by adding extra cells having the proper dimensions.

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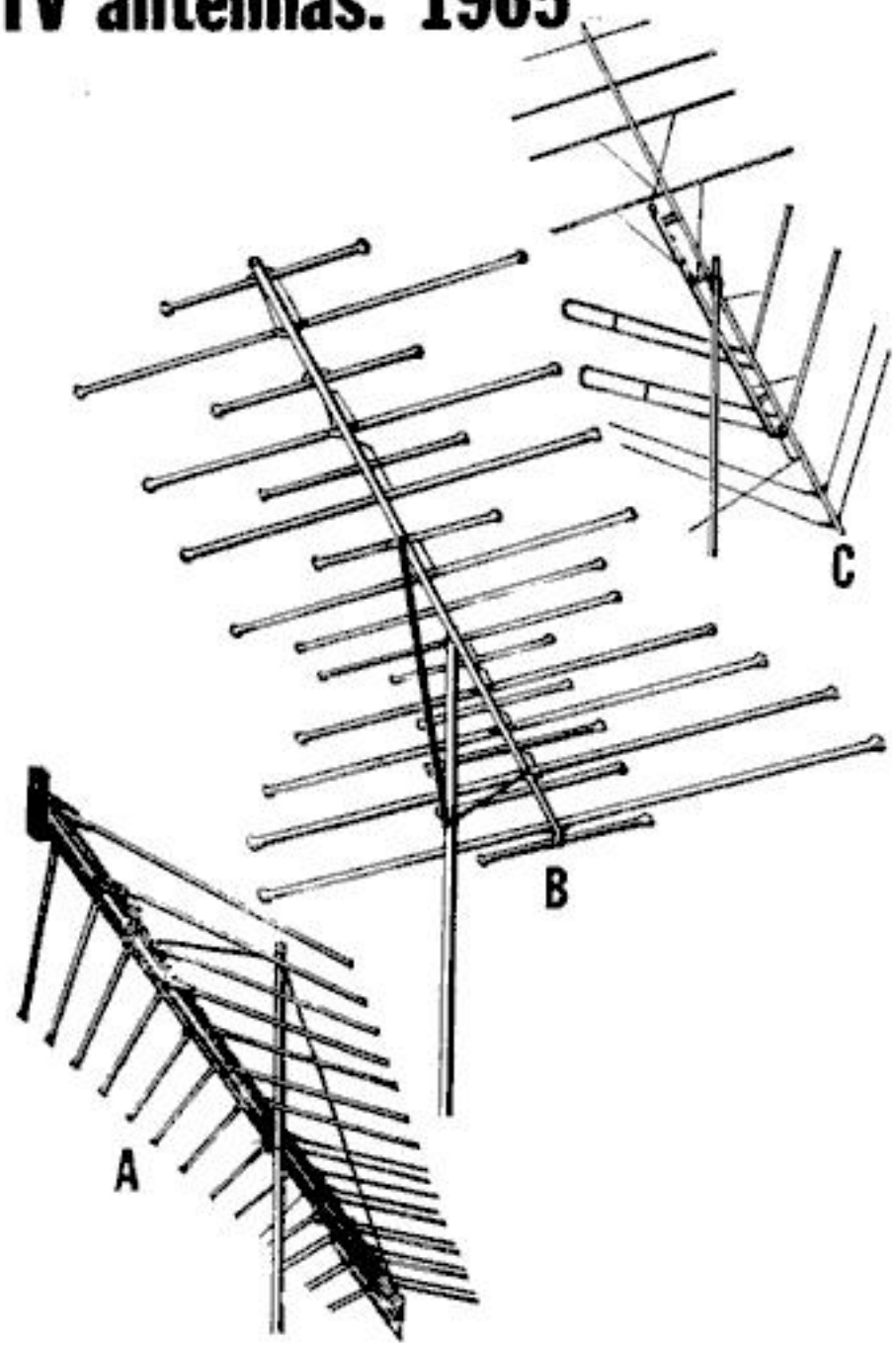
TV antennas: 1965



Your next antenna will look like these. New for '65 are dual-band UHF-VHF antennas, deep-fringe-area models with built-in boosters that can pull in signals from over 150 miles away, and high-gain color-TV antennas that are free from color-distorting signal dropouts. (A) JFD log-periodic LPV-VU18, (B) Winegard Super Colortron, (C) TACO 990-8 Electra.

tenna is at picking up signals that hit it head on.

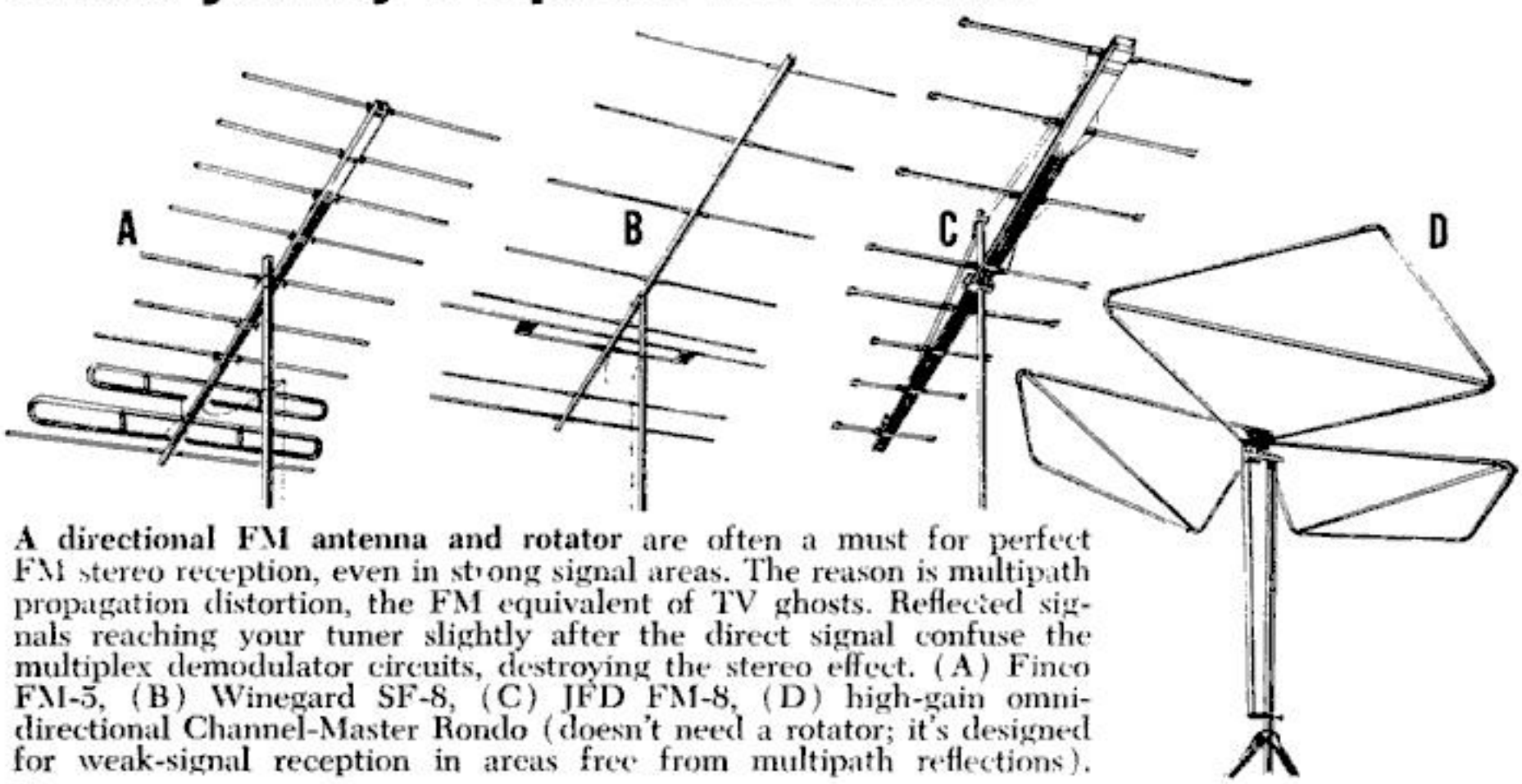
Directivity—a measure of an antenna's ability to reject signals striking it sideways and from behind. It's another way of describing how well an antenna can be pointed, or how wide an angle it covers.

Do you think you live in a fringe area? You may not, by today's standards. Five years ago, fringe area meant more than 50 miles from a TV station. But the new superpower, high-gain, deep-fringe antennas can pull in signals from over 150 miles away with ease. By replacing your yesteryear's fringe antenna, you may be able to pick up several additional channels. Is it worth the cost? That depends on how much you value a greater choice of programs when you watch TV.

Have you seen any ghosts lately? Ghost images on your screen are caused by reflected TV signals that bounce off nearby structures. Because they travel a longer distance, they strike your TV antenna slightly after the direct signal, confusing your set and producing a ghost. The only way to get rid of ghosts is to use a highly directional antenna. It can be aimed at the direct signal, and will ignore the reflected signals. (Ghost signals nearly always arrive from a different direction than the direct signal.)

Traditionally, ghosts have been a city-dweller's bugaboo, but they are haunting the suburbs in ever-growing numbers. A new nearby bridge, tall building, or water-

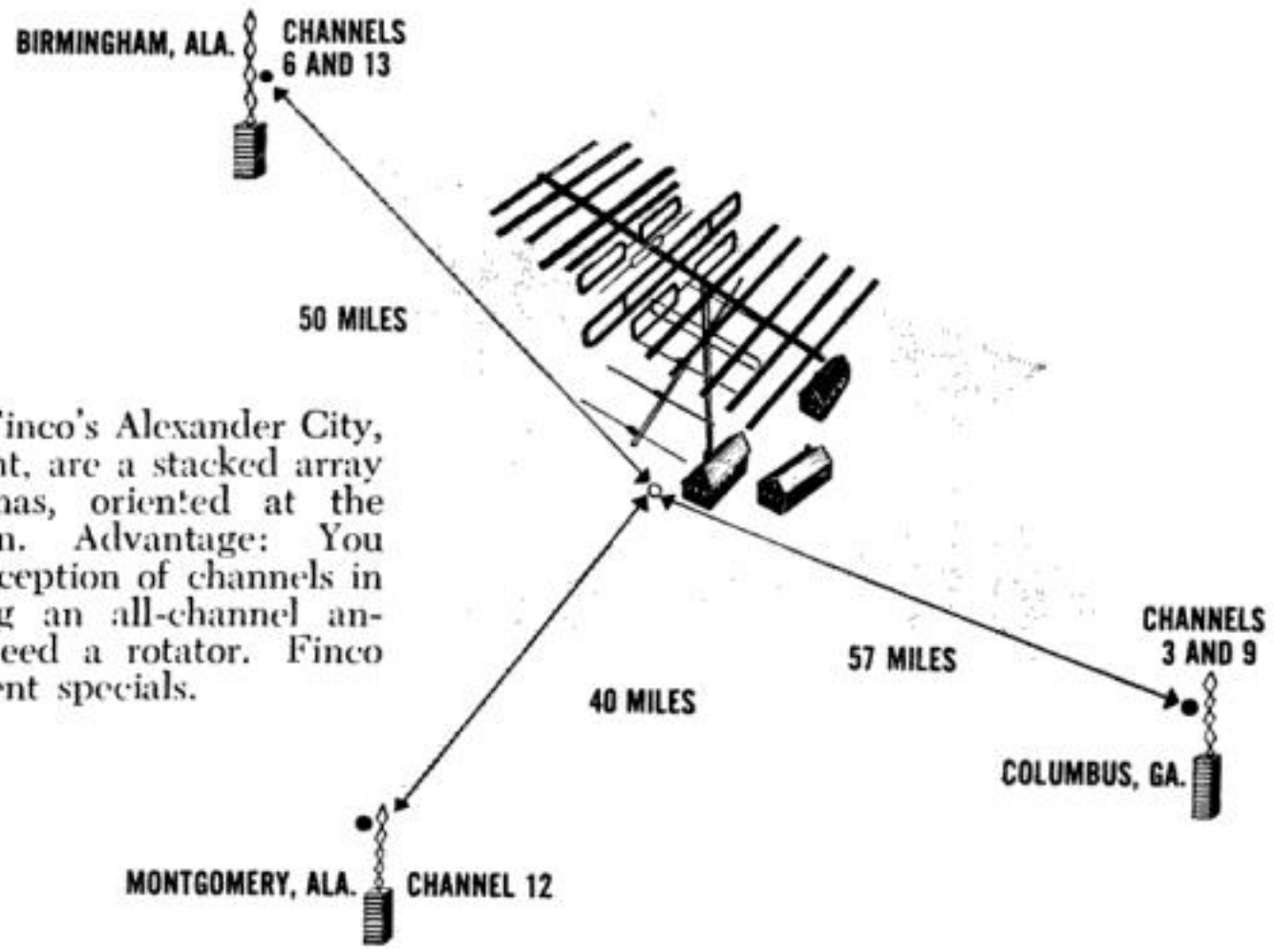
Should you buy a separate FM antenna?



A directional FM antenna and rotator are often a must for perfect FM stereo reception, even in strong signal areas. The reason is multipath propagation distortion, the FM equivalent of TV ghosts. Reflected signals reaching your tuner slightly after the direct signal confuse the multiplex demodulator circuits, destroying the stereo effect. (A) Finco FM-5, (B) Winegard SF-8, (C) JFD FM-8, (D) high-gain omnidirectional Channel-Master Rondo (doesn't need a rotator; it's designed for weak-signal reception in areas free from multipath reflections).

Urheberrecht ch geschütztes Material

You may need a custom job



"Special" antennas, like Finco's Alexander City, Ala., model shown at right, are a stacked array of single-channel antennas, oriented at the factory for one location. Advantage: You pay only for top-grade reception of channels in your area, unlike buying an all-channel antenna. And you don't need a rotator. Finco makes about 3,000 different specials.

storage tank may be bouncing ghost signals right at your antenna. If it's not directional enough to keep them off the screen, then it's time for a change. Also, a new TV set with a more sensitive front end may respond to weak ghost signals that your old set ignored.

If you live in the city, the big problem is TV interference—a composite of the clatter of modern high-voltage automobile-ignition systems and electrical machinery, the chatter of amateur radio and Citizens Band radio operators, and, of course, the clutter of ghost images.

Since urban areas are usually very strong signal areas—TV broadcast stations are located in cities—more city dwellers use the simplest possible antennas. Unfortunately, these economy-model antennas nearly always have poor directivity, making it impossible to aim away from interference.

If you're bothered by interference, the first step in the cure is to install a moderate-gain, highly directional antenna and aim it to minimize interference. A moderate-gain antenna will not overload your set's front end and cause distortion. If you are still bothered, replace the existing 300-ohm twin-lead lead-in wire with 300-ohm shielded twin-lead. As a last resort, have

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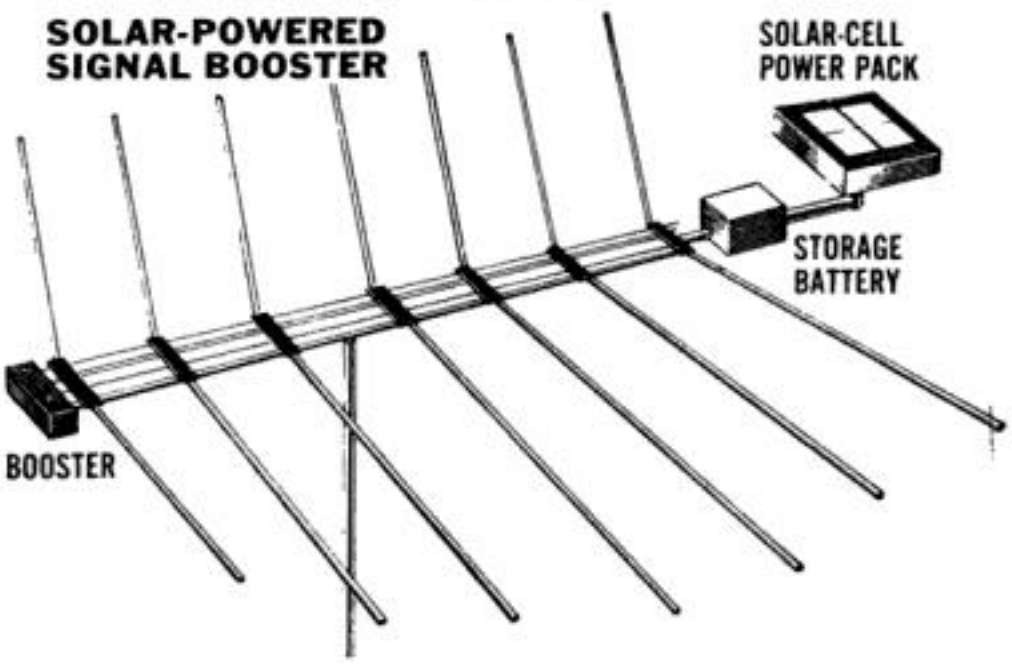
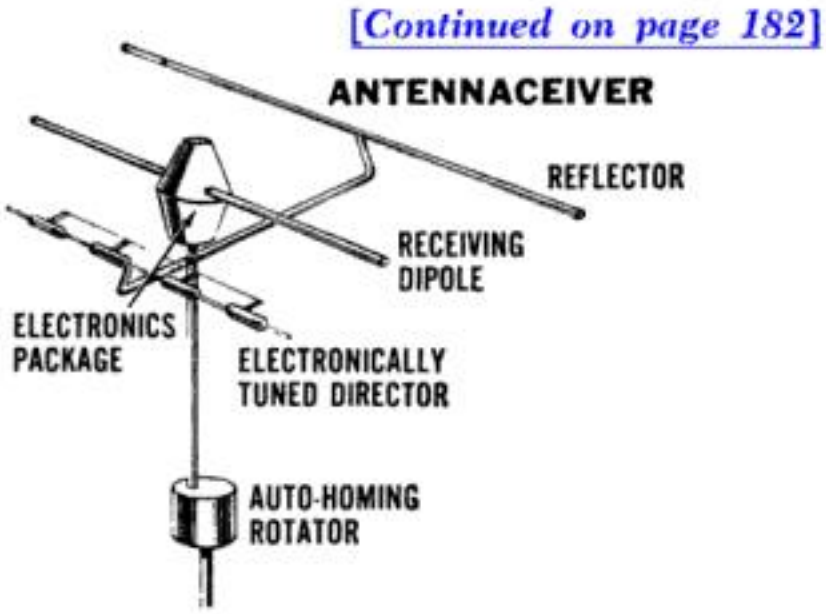
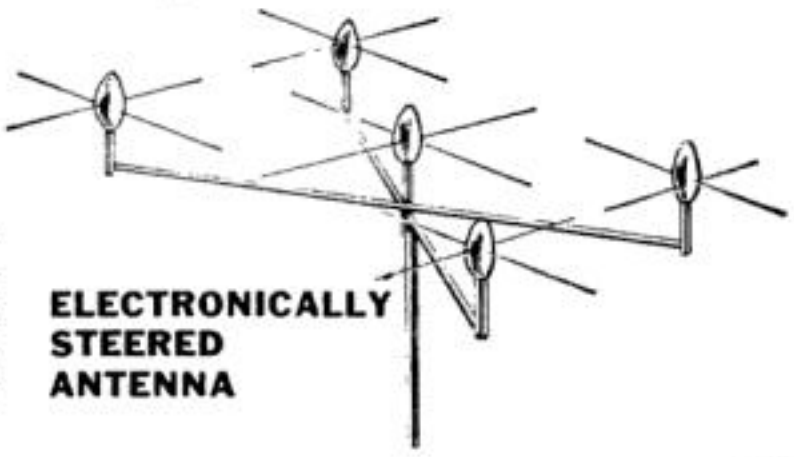
Antennas for 1975?







Solar cells power a solid-state signal booster. Automatically recharged battery takes over at night. Antennaceiver mates an antenna with a TV set's front-end circuitry and tuner stage for top efficiency. Electronically steered antenna has no rotator. It aims itself by comparing the phase of signals at each element.

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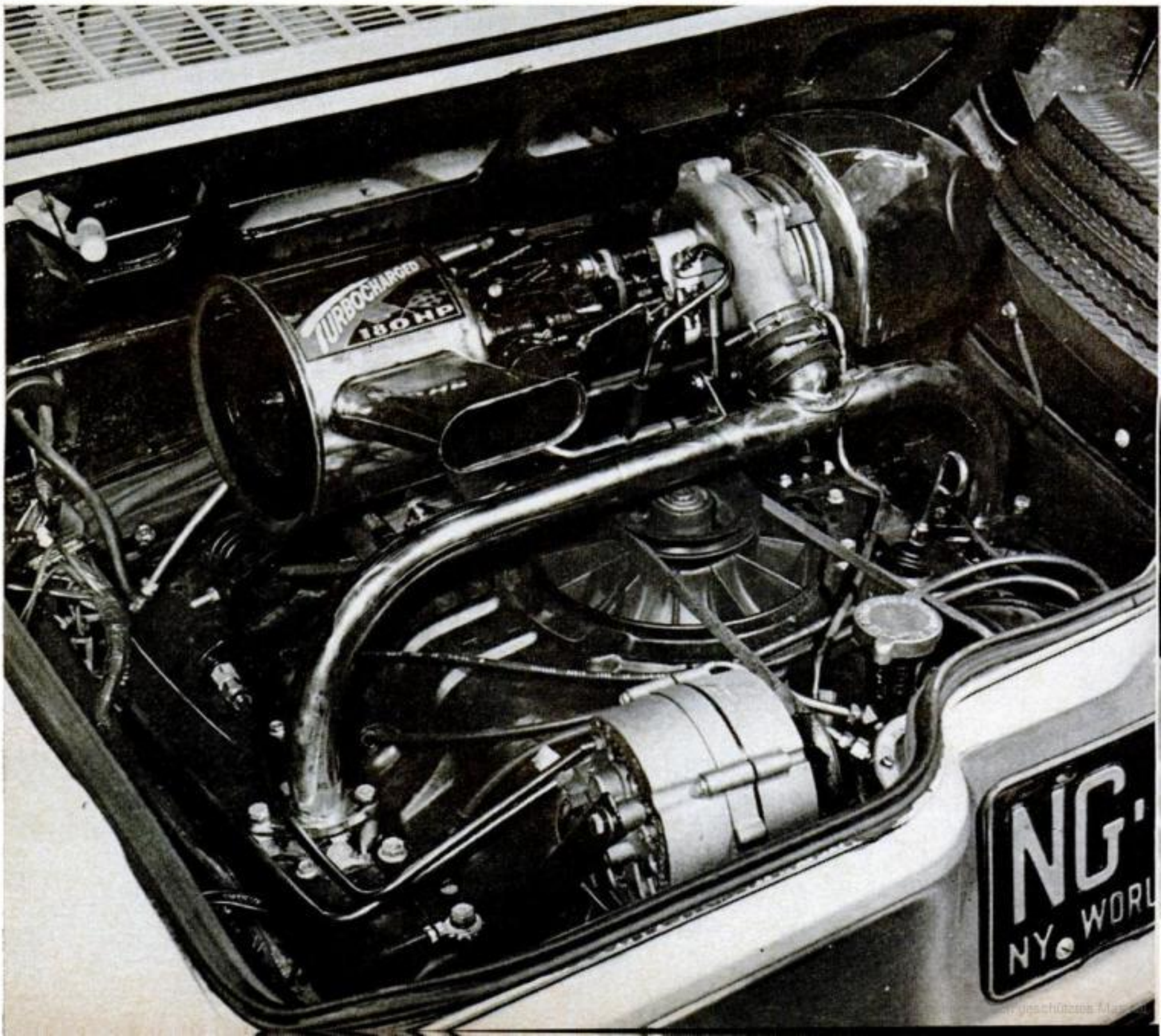
THE '65

REPORT FROM THE DRIVER'S SEAT

Long-legged drivers will find Corvair a compact with leg room unchanged from '60-'64 models. Rear leg room was increased by two inches, a worthwhile improvement. The adjustable (three-inches) wheel is great; it slides in or out on the column to provide reach for safe, comfortable steering.

Only noticeable change on this '65 turbocharged engine is the alternator, standard on all models. However, there are new cylinder heads, larger intake and exhaust valves, and larger turbines and compressor sections, increasing supercharger flow by 33 percent, hp. by 20 percent.



CORVAIR: How Much Better?

Our covey of Corvairs included, left to right, turbocharged 1965 convertible with stick shift; Fitch-modified '65 Monza coupe with Powerglide; four-carb '64 Monza with stick shift and full Fitch Sprint treatment; and, finally, a '63 "700" 80-hp. sedan with Powerglide.

By Jim Whipple

CAN it be as good as it looks? That was the question I asked myself when I first saw the '65 Corvair. Only 3.3 inches longer and 2.7 inches wider than the '64, it looked like a lot more car even though the wheelbase remained at 108 inches. It felt like a lot more car, too, when I tried it at the GM proving ground last summer.

But an hour or so on a proving ground with a prototype no more makes a real road test than a single swallow makes a summer.

I borrowed a Corsa convertible with four-speed synchromesh transmission and the 180-hp. turbocharged version of Corvair's 164-cubic-inch air-cooled six.

After driving it more than 500 miles in traffic-choked streets, on turnpikes, and over bumpy blacktop, I wound up at the Lime Rock sports car track in Connecticut. John Fitch, a former international sports-car champion driver and acknowledged high priest of the Corvair cult, met me there.

To spice up the proceedings and make for some interesting comparisons, John brought along three additional Corvairs: a '65 Monza Sprint coupe with a mildly modified engine and Powerglide; his own '64 Monza Sprint coupe with four-speed synchromesh and 155-hp., four-carburetor engine; and a plain-vanilla '63 Corvair sedan with Powerglide. But more about these Corvairs later.

Out on the highway in the 180-hp. turbocharged job, I found that for the first time Corvair can be a real performance car. On long hills on the turnpikes, drivers of big Oldsmobiles, Chryslers, and Pontiacs looked up in amazement as I roared past.

This car has the power, but you can't tap it until you've reached about 4,000 r.p.m.—so you need plenty of gear ratios and must use them properly.

Our high-gear acceleration runs on the track proved this out conclusively: The

CONTINUED

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Turbocharged '65 Corsa cornered well with very modest roll angle and with very little slide-out.

Suspension modifications on '65 Monza improved handling, boosted speed on curves.

car accelerated from 40 to 60 in 9.5 seconds, while 50-70 runs averaged 8.2 seconds.

But to really move this car, the trick is to watch the tachometer with one eye, keep the other on the road, and speed-shift your way up the speedometer dial.

I found that shifting out of each lower gear at the 5,500-r.p.m. red line on the tach gave me 60 m.p.h. in 9.5 seconds and 80 in 15.3 seconds. This kind of performance makes you competitive with the big 300-inch V-8s. You feel a bit like Little David having a go at Goliath every time you pull out to pass.

Cruising along in high gear with the standard final-drive ratio of 3.55:1, I found that the engine didn't really come to life until the speedometer needle hung on the 70 mark.

Trunk space, increased by .4 cubic foot, is more usable thanks to placement of jack in engine compartment along with spare tire.

You can't buy the turbocharged car with Powerglide, but this would be like asking Mickey Mantle to hit homers with a Ping-pong paddle. At $91.50 extra, the four-speed synchromesh manual transmission is a great buy (on other cars, four-speed costs more than twice as much) and I advise it no matter what engine you order on your Corvair.

A good choice. Unless you want to run with the hot ones and are willing to rev up and shift madly to do it, my recommendation for the '65 Corvair would be the 140-hp. job with the four single-barrel carbs. This one takes premium fuel like the turbocharged job, but costs about $150 less.

Either this or the John Fitch Sprint conversion of 155 hp. will give the Corvair plenty of power to keep up with today's fast-moving traffic with no strain on the hills. But if you like to zoom a little when conditions permit, have that extra $150 or so, and don't mind a pretty authoritative exhaust and engine noise, go turbo and live it up!

In stock trim, the car has the roadability to go with the turbocharger's performance potential, thanks to wider rear tread, low-profile tires, antiroll bar up front, and the totally new rear suspension. With the new design, the rear wheels move straight up and down going over a bump, without becoming pigeon-toed as in previous years.

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Quick steering plus tautly controlled decambered suspension on Fitch's '64 Sprint helped.

Classic Corvair cornering problems of cambering, yawing, rolling are shown on this stock '63 sedan.

You can corner hard, but you must really be unwise or unwary to have it break loose on you.

Brakes are another matter. At the high speeds and rapid acceleration that the supercharger permitted, the stock brakes were easily taxed, even though the lining area has been increased by 34 percent for '65.

Chevrolet formerly offered cerametallic linings which require a lot more pedal force when cold, but which will stop you as quickly as friction between tires and road permit. And the hotter they get, the better they work. My advice, if you buy a Corsa turbocharger, is to install this type of lining so you'll have "stop" that's equal to the "go."

To really appreciate what's been done in ride and handling on the '65, you've got to switch back and forth, as I did at the track, between the new and the old. The new suspension is softer—and better controlled. The car leans very little and that galloping pogo-stick motion of the

[*Continued on page 202*]

How the Corvairs compared in specifications and performance

	1965 CORSA Turbocharged Convertible	1965 MONZA Sprint Coupe	1964 MONZA Sprint Coupe	1963 "700" 4-Door Sedan
SPECIFICATIONS				
Wheelbase	108	108	108	108
Overall length	183.3	183.3	180	180
Overall width	69.7	69.7	67.5	67.5
Height	51.2	51.2	51.5	51.5
Engine type	Air-cooled, flat-opposed six with overhead valves			
Bore & stroke	3.43x2.94	3.43x2.94	3.43x2.94	3.43x2.60
Displacement	164 cu. in.	164 cu. in.	164 cu. in.	145 cu. in.
Compression ratio	8.25:1	9.25:1	9.25:1	8.0:1
Carburetors	1 1-bbl.	2 1-bbl.	4 1-bbl.	2 1-bbl.
Fuel grade	Premium	Premium	Premium	Regular
Horsepower	180	125	155	80
Torque	—	—	202 lb.-ft.	128 lb.-ft.
Transmission	4-speed manual synchromesh	Powerglide 2 speed & torque converter	4-speed manual synchromesh	Powerglide 2-speed & torque converter
Axle ratio	3.55:1	3.27:1	3.55:1	3.27:1
Curb weight (lb.)	2,685	2,545	2,530	2,535
PERFORMANCE (Seconds)				
0-60 m.p.h.	9.5	13.0	11.2	20.5
0-80 m.p.h.	15.3	24.3	22.3	36.7
*40-60 m.p.h.	9.5	7.8	9.6	11.0
*50-70 m.p.h.	8.2	9.8	9.8	15.0
SS ½-mile	20.2 (90 m.p.h.)	23.9 (78 m.p.h.)	22.3 (85 m.p.h.)	27.6 (68 m.p.h.)

*In high gear.

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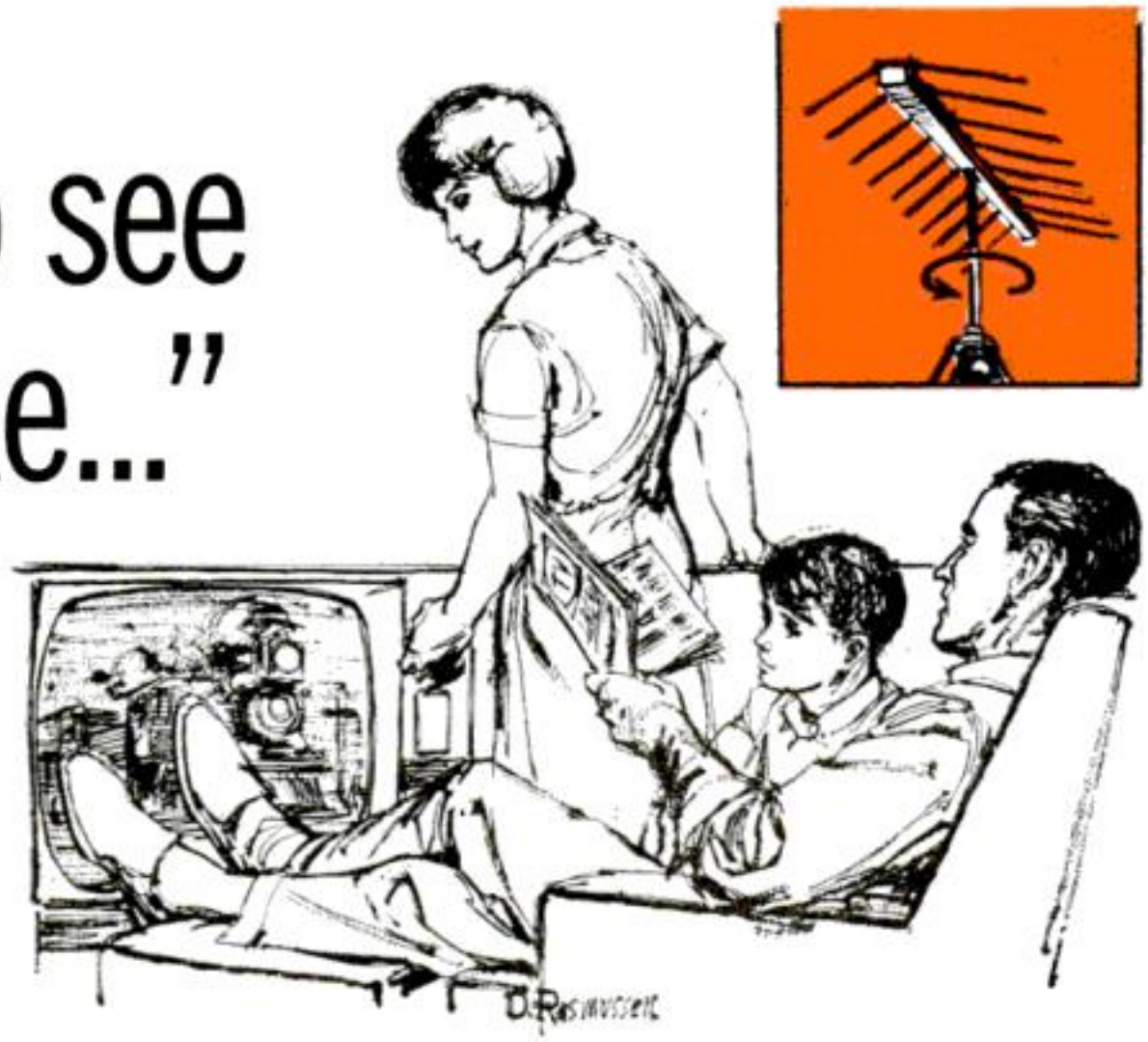
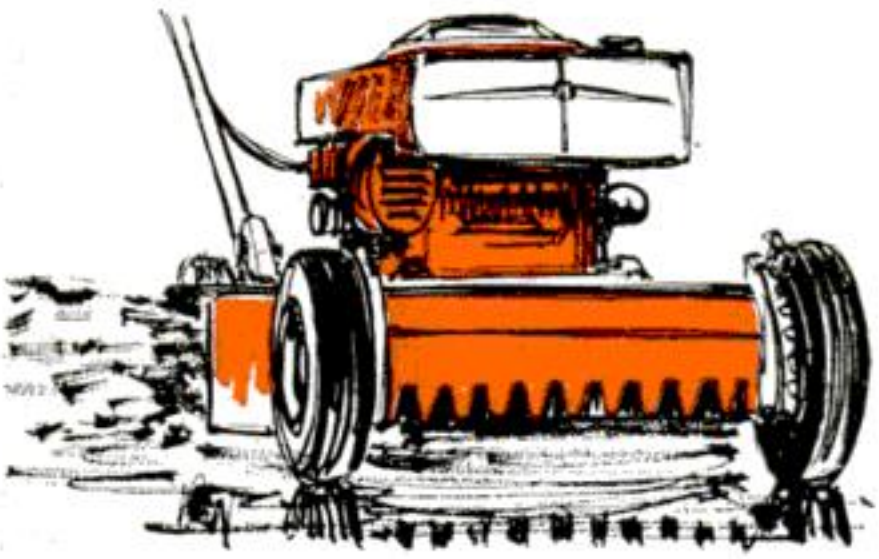
"I'd like to see them make..."



A TV-antenna rotator connected to the channel-selector switch. Turning the set to the channel wanted would also turn the antenna automatically for best reception.—*J. D. Sterringer, Mississippi City, Miss.*

Either-end caps for spray cans. They'd fit over the base like a fountain-pen cap and eliminate the hunt for the top every time after you used the spray.—*Ira Schaefer, Brooklyn, N.Y.*

A built-in scale on adjustable-end wrenches so you could readily determine the diameter of any round object—pipe, rod, bolts, and the like.—*Charles J. Orem, Indianapolis, Ind.*



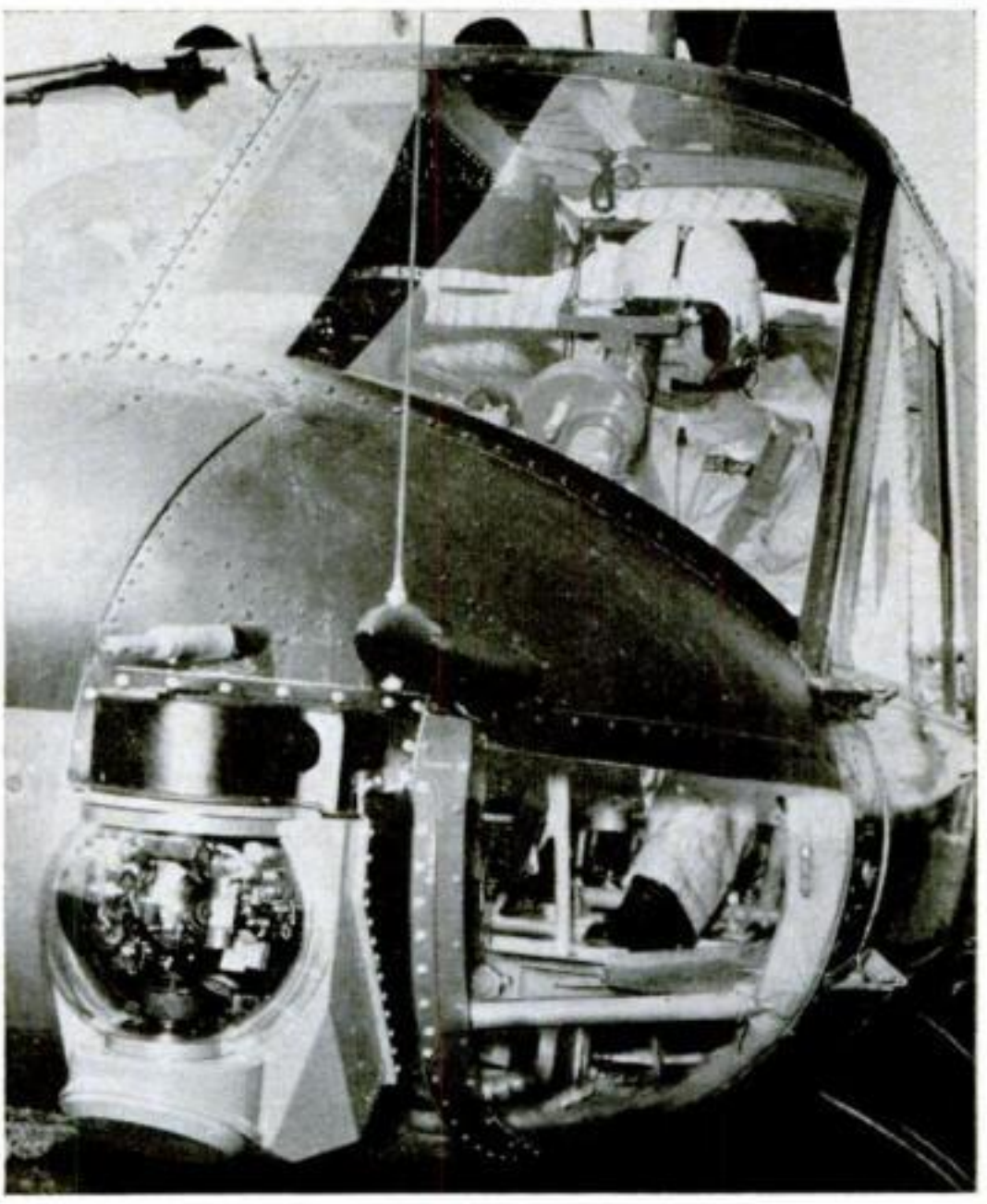
An ice-scraping blade for rotary lawn mowers. Stiff wire brushes at each end of the blade would loosen hardened snow or thin ice to make removal easier.—*P. Rushing, LaGrange, Ill.*

Hot-up case for car-ignition keys. Turn on the battery heating coil (or chemical warmer) and the key would defrost a frozen lock.—*Joseph Gajewski, Jersey City, N.J.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.

Backpack thirst quencher

Designed for camping or hiking in areas where you're not sure of the water supply, this German knapsack solves the problem. It holds six gallons, enough for several days' camping or a big group hike. If there's no one to hold a glass under the spigot, you can hang the bag up by its top straps.



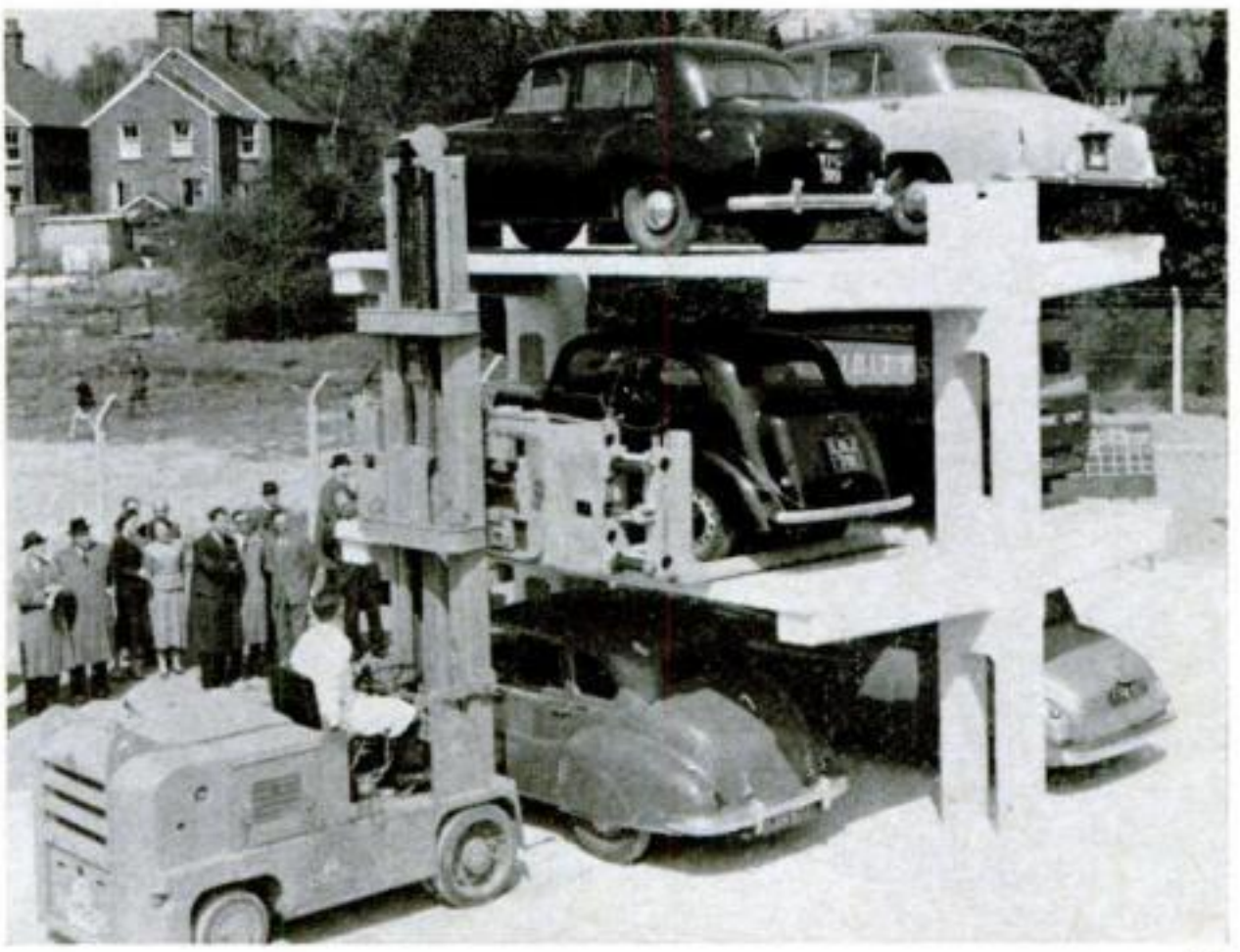
Missile-aiming sight built for helicopters

Missile kills of enemy tanks are surer with the aid of a stabilizing sight that isolates its high-power telescope from the angular motions and vibrations of a maneuvering helicopter, giving the pilot a blur-free view. The Philco sight has scored bull's-eyes with a series of antitank Shillelagh missiles on both moving and stationary targets.

Forklift stacks cars for economy parking

The forklift parker at right multiplies the capacity of outdoor lots, stacking cars at three heights on parallel rows of cantilevered shelves.

The British inventor added patented lifting fingers to a standard heavy-duty fork truck. The twin fingers spread apart to match a car's wheelbase, passing on the outside of the tires, then clamping together for support. Ground-level cars are driven into place.



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Jungle carrier opens to double as a boat

A litter-like covered cart in which jungle troops can transport ammunition and other supplies is being tested by the Army. Made of fiberglass, it's equipped with hand shafts in front and behind, rolls on a single wheel mounted in a well. At streams that can't be waded, lid and bottom are separated and joined together side by side with two handles to form a catamaran. The other two handles are used as paddles. The cart holds 250 pounds.

Self-navigating robot gets its own charge

A machine that recharges its batteries by finding and plugging into the nearest wall outlet is under test at Johns Hopkins University Applied Physics Laboratory.

Like a hatbox full of bees, it buzzes up and down a hall, probing ahead to avoid open doors, stairs, and other obstacles.

Equipped with sonar, the robot may find use in moon or undersea explorations.

Berths for overnight bus riders

Facing double seats on the German highway coach at right are made up as Pullman berths for night-time riders. Seat cushions slide forward to sleep two on a lower deck, while mattresses, stored under overhead luggage racks, drop to form upper berths.

Window blinds and curtains enclose each of the 10 four-berth compartments for privacy.

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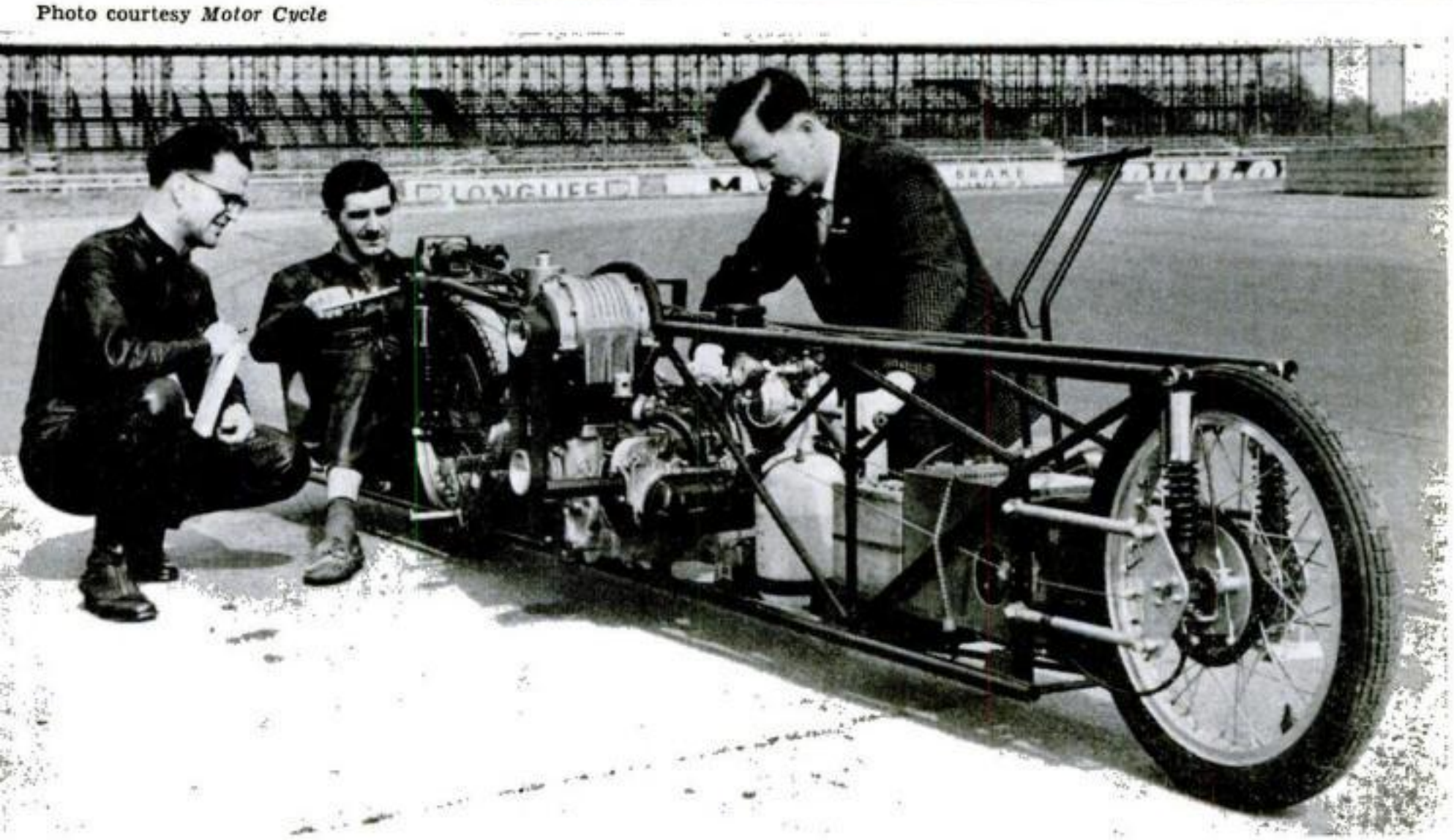
Underwater "space" trains astronauts

Breathing through a face mask and tube, the underwater swimmer at right finds it impossible to keep his feet on the floor as he touches his toes. By exhaling and inhaling, he maintains zero buoyancy, simulating the weightlessness of an astronaut in space.

Zero-buoyancy tests were conducted by an aerospace medical and General Dynamics team at Wright-Patterson Air Force Base. Checkered background and markings on body form reference points for a movie.

Photo courtesy *Motor Cycle*



Motorcycle dragster is 13 feet long

This odd-looking motorcycle is designed for drag racing. The rider sits behind the rear wheel for better traction, but is counterbalanced by the outrigged front wheel so the machine can't rear up and leave him stranded. Mounted amidships is a supercharged Volkswagen engine sleeved down to 60 cubic inches to meet competition regulations. Clive Way, British missile engineer, plans to beef up the power, but so far has done a quarter-mile in 12.1 seconds with a terminal speed of 120 m.p.h.

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For '65, these hustling engines bring you more power, new designs, easier controls

New Stern Drives Are

By Jim Roe

IF YOU'VE been waiting and wondering about the performance and future of stern drives, be advised: The performance is red-hot.

Why the popularity? Some reasons are brand-new: a wide range of horsepower with a stern drive for practically any boat; clean new designs; more and more new, easily operated controls such as single-lever shifting, power steering, power tilt. Other reasons are the same ones that first caused this marriage of an inboard motor and an outboard drive. These include high horsepower, a full-height transom with its protection against following seas, and an "inboard look." A stern drive is as easy to drive as an outboard, since it acts in exactly the same way. It's easier to install than a regulation inboard drive. The safety kickup and the power tilt allow you to go places you wouldn't dare chance in a regular inboard boat—and also give you the ability to get out of trouble if you encounter shoal water. And stern-drive boats are as easily trailered as outboards.

Here are the three most-often-asked questions about stern drives:

1. How much does a stern drive cost?

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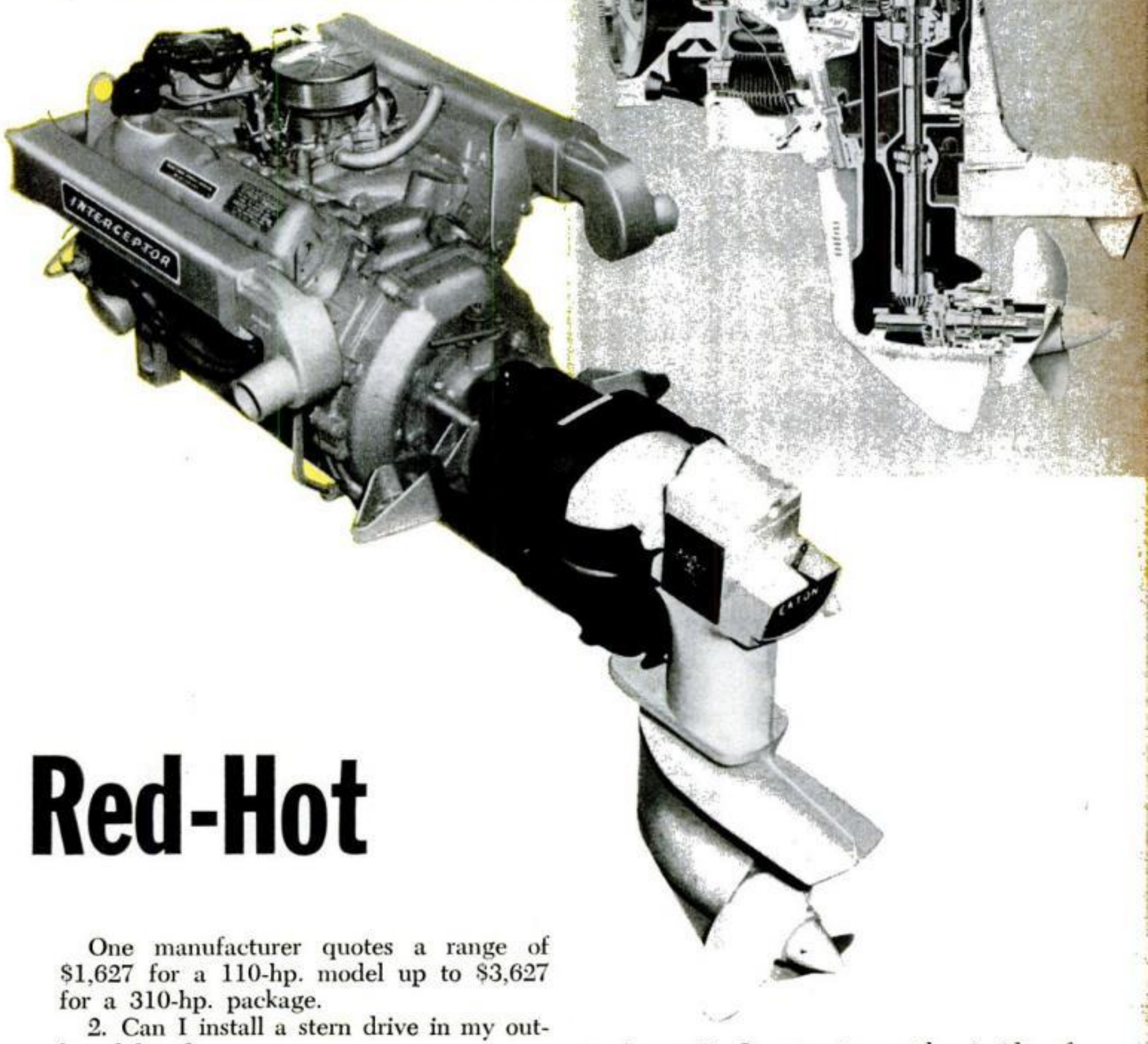

Even a diesel: MerCruiser's 60-hp. stern drive powers boat at left. At right: Volvo's new unit has electric tilt to 65 degrees. Outdrive automatically centers while lifting, operates tipped-up in shallow water. Below: Interceptor outdrive unit disconnects easily for trailering, has stainless-steel mufflers, rotates 360 degrees with optional hand crank or electric tilt mechanism.

Red-Hot

One manufacturer quotes a range of $1,627 for a 110-hp. model up to $3,627 for a 310-hp. package.

2. Can I install a stern drive in my outboard boat?

Usually, yes. But to determine whether or not you will want to, study these points: A) Compare the cost of buying a new boat, with stern drive already installed, with the cost of remodeling your own boat's transom, plus the cost of a stern-drive unit, plus about $125 for installation. B) Make certain your boat will carry the extra horsepower. C) Check to see that your transom is strong enough to support the extra weight of the engine unit. It mounts on the inside of the transom. D) Consider the space lost inside the boat. Sometimes the stern-drive motor leaves you with *more* usable space in the boat than the motor well that extends forward from the transom. E) Check design. The transom must be at a proper angle to the boat's bottom.

3. Can I repower my inboard boat with a stern drive?

Yes, but again consider the comparative

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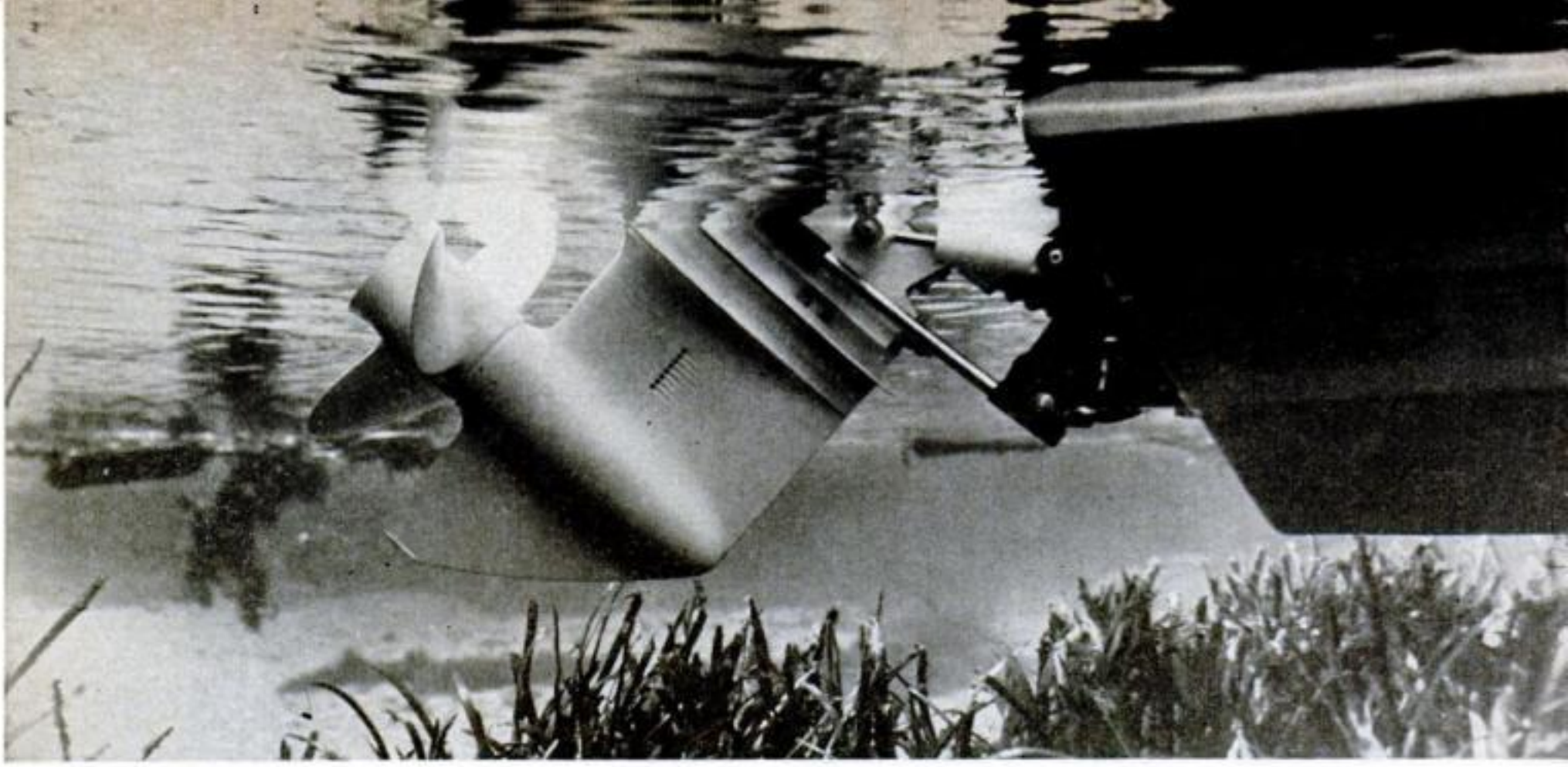

Try this with a straight inboard! Stern-drive units like this MerCruiser simply tilt up and keep working in shallow water. The tilt feature is also useful for launching, loading, highway trailering. Most outdrives tilt at the touch of a button, by hydraulic or electric power.

cost of buying a new boat already powered by stern drive. And make sure the transom is hefty enough—or build it up so it is—to take the full thrust of the propeller. A straight inboard normally transmits the propeller's thrust to stringers inside the hull.

The sophisticated '65 stern drives promise—and deliver—more than ever before. Here are some of the engineering features you will find:

MerCruiser. There are seven models. Six gasoline-powered units range from 110 to 310 hp. And there is a 60-hp. diesel. All feature a jet-prop exhaust, fired through the propeller hub. The propeller has no shear pin. A safety clutch allows no slippage under normal driving loads, momentary slippage under severe impact. The lower-unit housing is one piece of die-cast aluminum. There are all manner of niceties such as power tilt, hydraulic shock absorbers with a safety tilt switch, hydraulic power steering, power shifting, single-lever throttle and shift control, and Ride-Guide single-cable steering.

OMC (Outboard Marine Corp.). Four stern-drive horsepower packages are offered for 1965. These start at 90, go to 110, 120, and top out with a V-6 150-hp. job.

I have tested all of these power options and they operate so quietly I had to look at the tach while idling, to be sure the engine was kicking over.

The two-cycle 90-hp. unit has been redesigned for '65. The separate oil pump has been eliminated. Premixed fuel can be used, and a 50:1 gas-oil ratio is recommended. The junction box is gone: The necessary wiring has been built into the engine itself.

All OMC stern-drive engines have vibration-free rubber mountings to isolate the engine from the hull. All have full electric shift with either pushbutton or single-lever control. A power tilt is electrically operated from the driver's seat.

West Bend's Sharkomatic 800. This 80-hp. four-in-line, two-cycle unit for '65 features compact inboard styling and two-cycle acceleration. In tests, the Sharkomatic 800 accelerated a 15-foot fiberglass runabout from idle to 20 miles an hour in 4.1 seconds.

Volvo. There are two horsepower sizes: 100 and 110. There is a completely new outdrive unit called the Model 200. It has an electric lift as standard equipment, underwater intake and exhaust contained in the outdrive unit itself. All steering and shifting controls are enclosed, with nothing left outside to catch or snag.

Interceptor. Inboard-outboards are available in three horsepower sizes: 120, 140, and 165. The big change in 1965 is less noise; stainless-steel mufflers see to this. The unit can be rotated 360 degrees, with the option of performing this trick either with a mechanical crank or electrically.

Chrysler. There are inboard-outboard systems in nine horsepower ratings. Best known is the Space-Saver Six. This 145-hp. engine is only 17 inches high. It's designed

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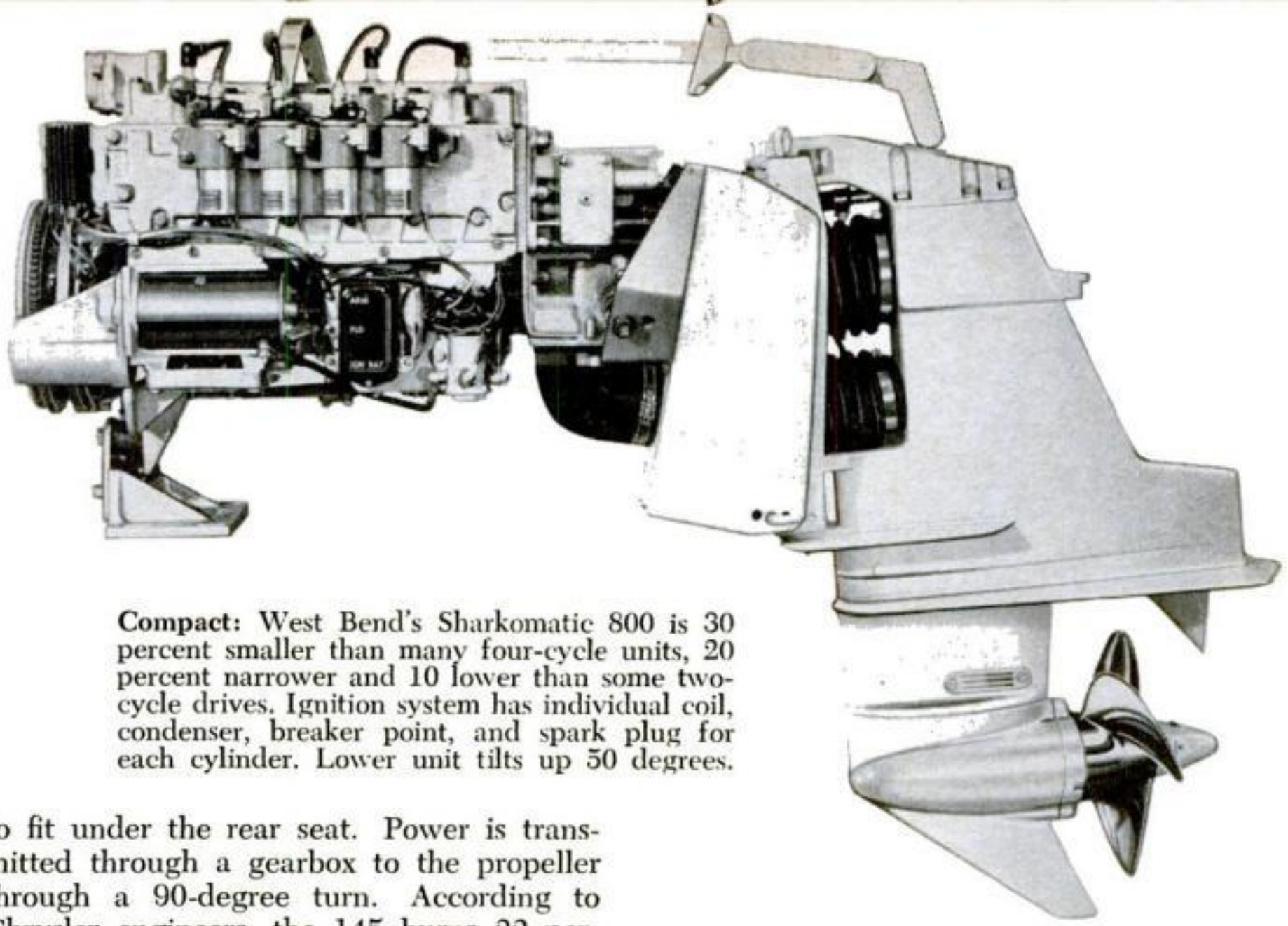


Compact: West Bend's Sharkomatic 800 is 30 percent smaller than many four-cycle units, 20 percent narrower and 10 lower than some two-cycle drives. Ignition system has individual coil, condenser, breaker point, and spark plug for each cylinder. Lower unit tilts up 50 degrees.

to fit under the rear seat. Power is transmitted through a gearbox to the propeller through a 90-degree turn. According to Chrysler engineers, the 145 burns 22 percent less fuel than a 100-hp. outboard.

Roylyn Sea Hawk. This is a new drive designed to be coupled to nearly any inboard engine from 60 to 200 hp. It rotates 360 degrees horizontally, and can operate in a "tractor," or pulling, position equally as well as in the traditional way. It also tilts up 180 degrees to put the propeller up over the top of the transom for trailering or launching.

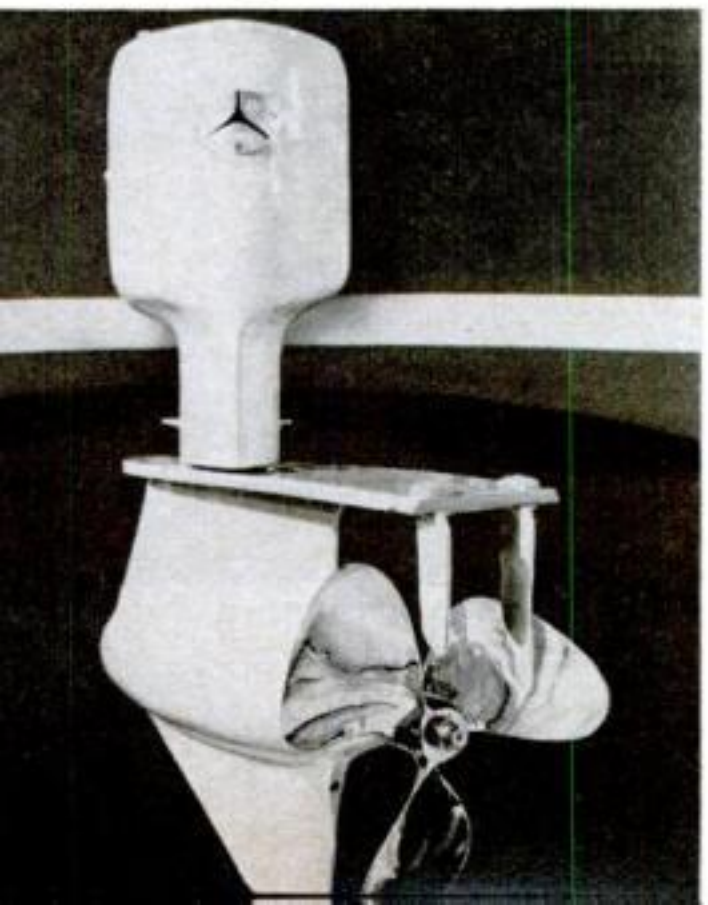
Hydro Drive. The new C-327 is designed for engines of up to 327 cubic inches. The really big news about it is that everything is enclosed in the outdrive unit. All you see extending from the transom is a clean casting. ■ ■

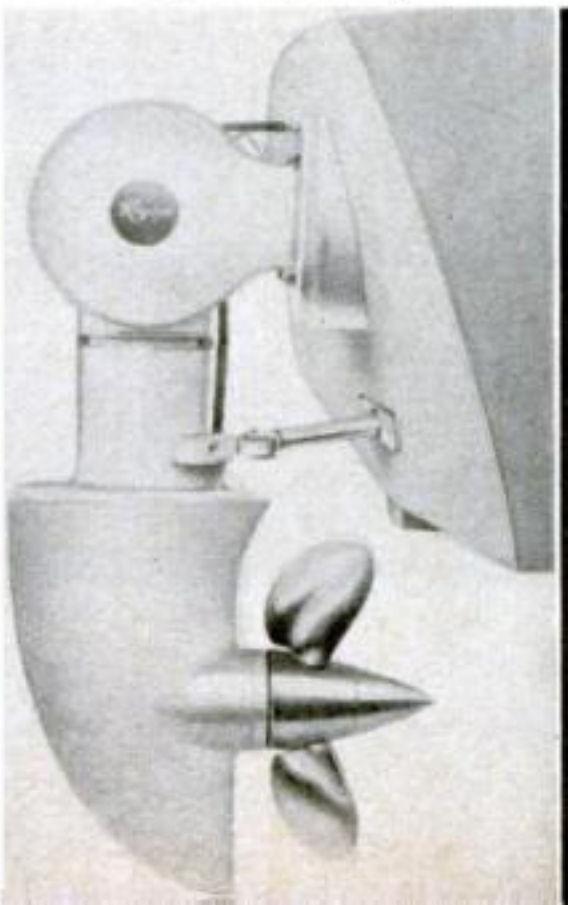
Some of the new features in the '65 stern drives

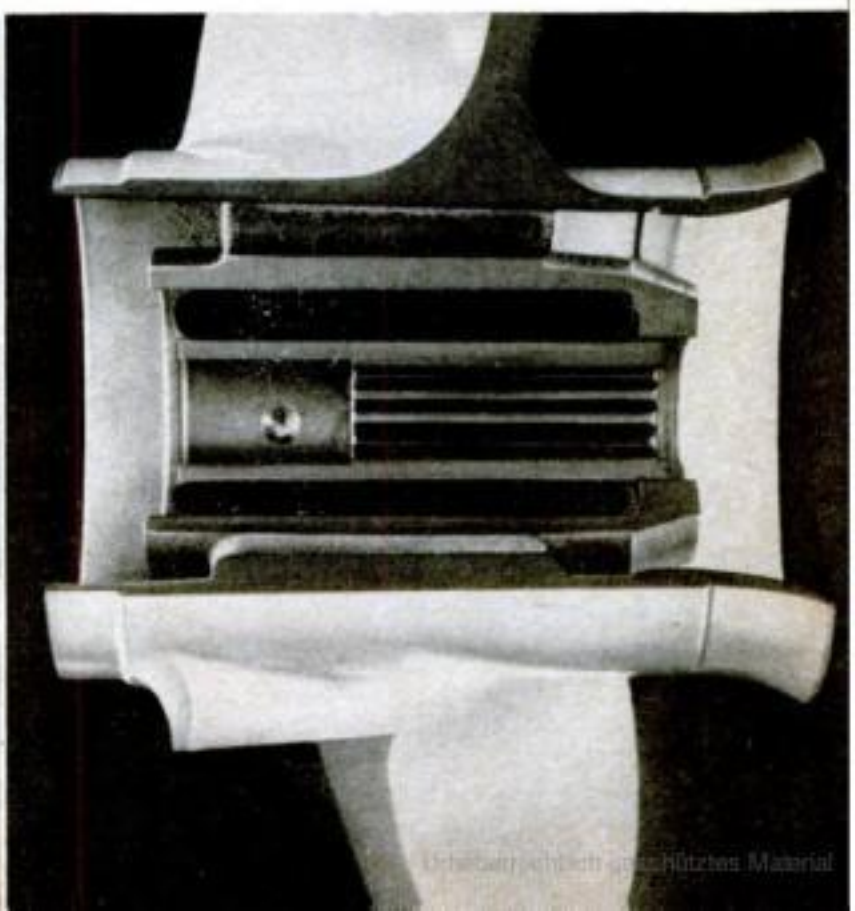
All controls are built into Hydro Drive housing. Steering is rack and pinion. Tilt—hydraulic—is up 90 degrees, operates in any position. Twin trim tabs balance torque. The unit can be used with any marine engine up to 250 horsepower.

Adjustable-pitch prop of Roylyn Sea Hawk has six positions from 12" to 18". Unit operates in drive or "tractor" position, has only 135 parts. Built-in clutch allows easy shifting even at moderately high r.p.m. The drive weighs only 70 pounds.

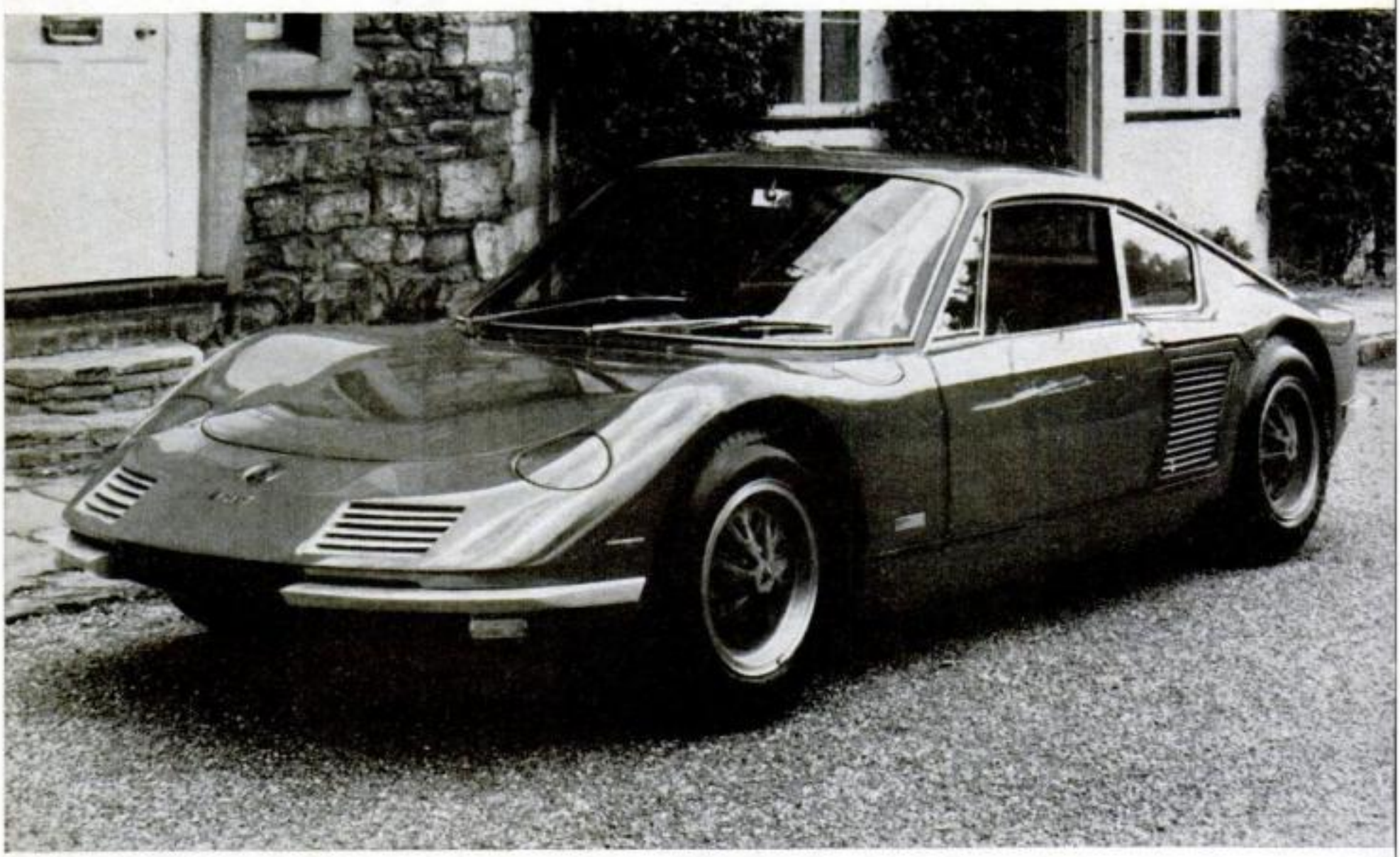
Cross section of jet-prop hub shows exhaust passage, safety clutch, and drive splines that fill mating splines on MerCruiser prop shaft. Flared trailing edge on blade hub assists exhaust-gas flow and improves water flow around the blades.







Highlights of the foreign car shows



Speedster is a four-nation design

Assembled by Elva in England, the Elva-BMW GT 160 has a British-built chassis, French-styled Italian-made body, and a BMW engine from Germany. Its rear-mounted, 121-inch, 186-hp. engine is said to take it to 160 m.p.h. The wedge-nosed body has twin radiators in front and flanking louvers for direct rear-engine cooling.

French introduce a new station wagon

A station-wagon version of Citroen's Ami-6 forgoes the sedan's notched back for a top-hinged tailgate opening a 60-cubic-foot cargo compartment. Its 25-hp., air-cooled, flat twin drives front wheels through a four-speed all-synchro gearbox. Longitudinal double-ended spring coils linked to suspension arms reduce pitching motion. Up to five can be seated.

Stretched-out French sports car

More leg room in rear bucket seats is provided in the front-drive, four-seat luxury Panhard 24-BT Berline. A 51.7-inch, air-cooled, two-cylinder engine churns out 60 hp. for a 100-m.p.h. top speed and 45 miles per gallon. All-around disk brakes are supplemented by dual-caliper units in front. The steering column is adjustable.

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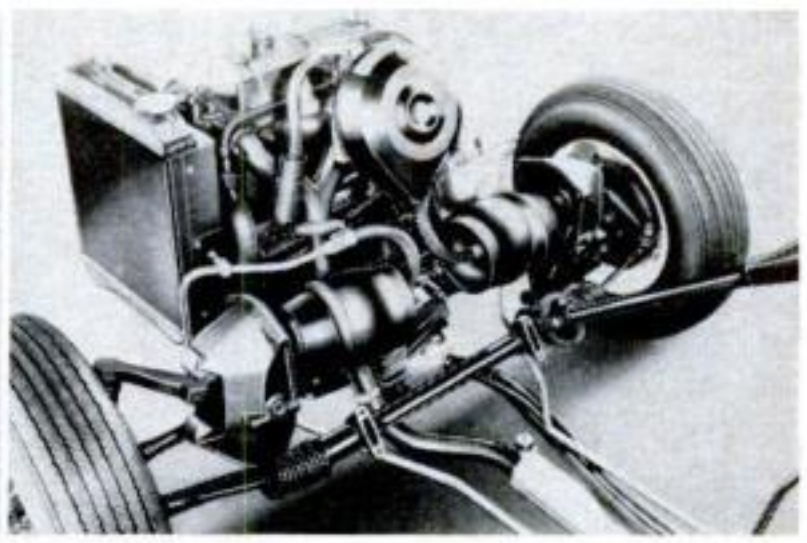
Low plastic body for fancy Britisher

Based on a Triumph Herald chassis, the Bond Equipe GT4S is powered by a 70-inch Spitfire engine with dual SU carburetors and 9:1 compression. The 63-hp. unit hits a top speed of 85-plus.

The four-seat coupe is 13 feet long, under 4½ high. It has four sunken headlights, a square tail, walnut dash, pile carpets, and adjustable seats.



New Austin has big-car room

Cross-mounting the 84-hp. engine, as shown at right, leaves more space for passengers in the 13-foot, 8-inch Austin 1800. Front-wheel drive and underslung four-speed transaxle give a humpless floor. The 56-inch-wide rear seat holds three adults in comfort, and curved side windows add width. Trunk space is 17 cubic feet.

Four eyes for Soviet sedan

Russia's latest, the Moskvitch 408, is Western-styled for across-curtain sales. A split back rest folds individually for a single or double bed. Designed for severe winters, the 60-hp. engine has a water-heated inlet manifold, two separate oil filters, and a radiator blind. The 13½-foot car weighs a ton and can do 70 m.p.h.

Tops in Italian luxury

Maserati's Quatro Porte has a powerful 252-inch V-8 engine with four overhead camshafts and four dual-choke carbs. Output is 290 hp. transmitted through a five-speed gearbox and De Dion rear axle. All wheels have disk brakes. The elegant four-door, with cost-no-object interior fittings, is 15½ feet long. It's said to make 140 m.p.h.

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PS ELECTRONICS

FIRST REPORT:

Spinning Head Tapes TV at Home

Loewe-Opta home TV recorder (above) records one hour on an 8" tape reel. It can be built into a console TV for off-the-air recording. Philips unit (below)—to be called the Norelco recorder in the U.S.—records 45 minutes on a 5½" reel of tape. Both can make "home movies"—an accessory camera catches action.

IS THIS the year you mate a home TV tape recorder to your TV set? Two European electronics firms—Philips (Netherlands) and Loewe-Opta (West Germany) are now selling TV recorders specially designed for home use. Both will be available here in a few months.

To capture the details of a TV picture, the recorder must have a three-megacycle recording bandwidth. Earlier prototype home TV recorders were essentially scaled-up audio recorders: They achieved wide bandwidth by moving ¼-inch-wide audio-type tape past a stationary recording head at high speed (usually 120 inches per second). High tape speed leads to excessive head and tape wear, and gobbles up tape at an uneconomical rate.

Both the Philips and Loewe-Opta recorders use one-inch-wide video-recording tape and a rotating recording head. The tape is threaded in a single spiral around a slotted drum that contains a spinning recording head rotating at about 3,000 r.p.m. Tape speed around the drum is about six inches a second. The rotating head records the TV picture signal on adjacent diagonal bands on the tape. The audio is recorded along the edge of the tape.

Both units are expensive—over $2,000 with accessories—but cost should drop as sales rise.

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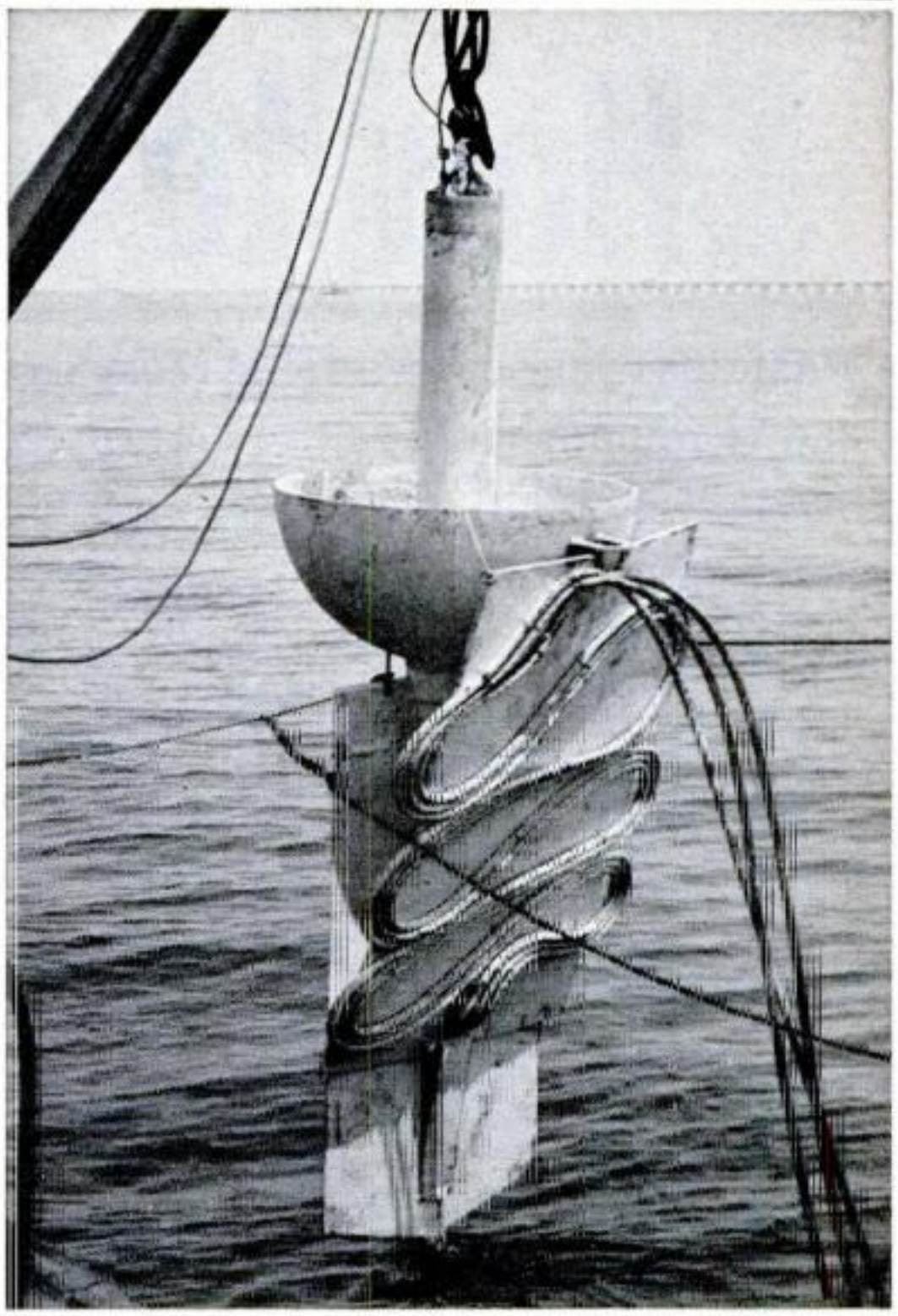
Giant rear-view mirror

Mounted in a Plexiglas turret sealing a hole in the roof, this monster rear-view mirror gives a driver an extra-wide view of the road behind. Built by Karl E. Smith, Fresno, Calif., musician, it consists of three mirrors. The big one reflects the road, smaller ones at the roof re-reflect the image so the driver sees it just above eye level.

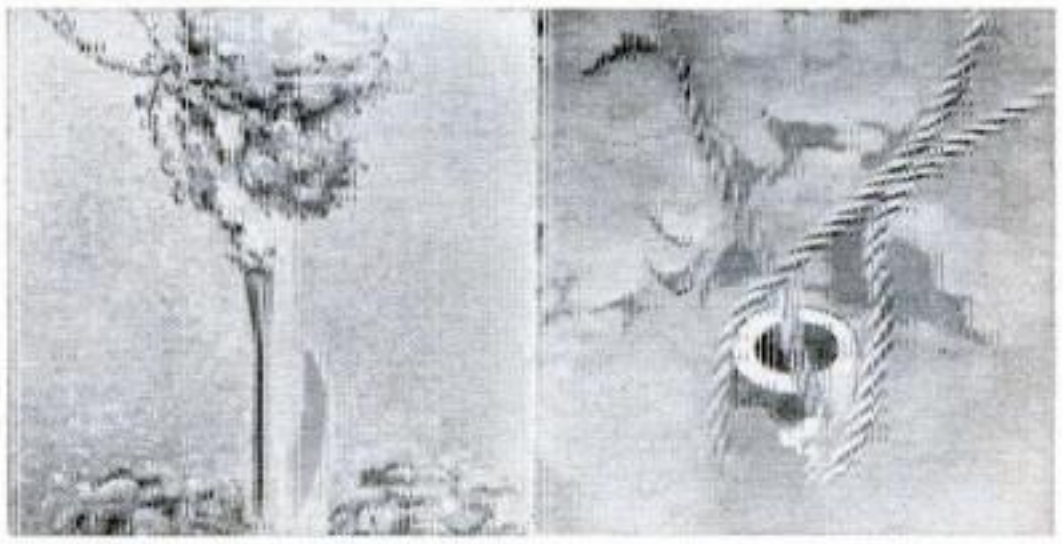
Home water purifier

Pure drinking water is always on hand with a new home purifier (below) regardless of chemical or other impurities.

Aquaspring is a combination vaporizer and condenser, works on household current, delivering distillate to a plastic bottle. It's made by American Machine & Foundry Co., sold by Good Hope Water Co. of Jacksonville, Fla.



Barrel-anchor assembly holds 16 pounds of propellant.



Impact triggers fuse..... to embed anchor in bottom.

Ship anchor shoots into bottom

An experimental explosive anchor has been developed by the Army Engineers at Fort Belvoir, Va. Weighing only 3,300 pounds, it does the work of a conventional anchor of 55,000 pounds, mooring a 40,000-ton tanker to the ocean floor for delivery of oil to underwater pipelines. A charge in a recoverable barrel is set off on impact, embeds the anchor portion deep in the bottom. The anchor is expendable. The ship cuts the line and leaves it.

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How to Sweeten a

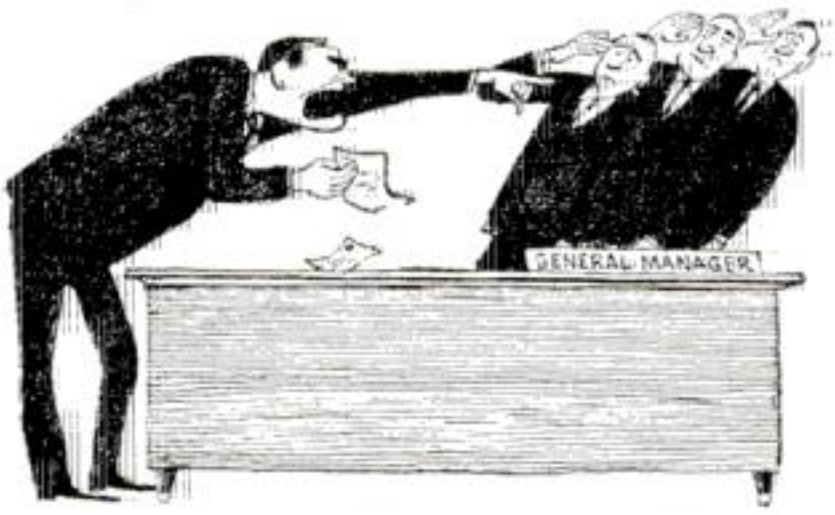
What does your car warranty really cover? Where, how, and to whom should you squawk? Here PS quotes actual case histories and tells you step by step what to do

By Bill Taylor Illustrations by Carl Rose

HARDLY a ripple marred the surface of the quiet side street, but Albert Tobey's three-month-old pickup truck shook like a nervous bridegroom. He shifted into second. Suddenly, the shift lever was wrenched out of his hand, and the truck shuddered to a halt, engine racing.

Cutting the switch, he climbed down and peered under the truck. There, in a gathering pool of oil in the road, lay the transmission.

Tobey called the dealer and asked



Nothing gets action like a letter to the top brass of a company.

him to tow the truck away. "Too busy," was the reply.

Next morning, Tobey hired a lawyer. Following his attorney's advice, he called on the dealer and insisted that the pickup be hauled away and repaired.

Three weeks went by. "Can't get the parts," was the dealer's curt answer to Tobey's inquiries. During this period, the frustrated owner tried one letter and four long-distance calls to the manufacturer's regional office in attempts to make an appointment with a factory service representative.

Finally, in desperation, Tobey wrote to the company's general manager and struck the nerve that started things moving. His complaint was fired back to the regional office. Even before Tobey received an acknowledgement of his letter, he was notified by the dealer that his truck was ready to roll again.

The name, Albert Tobey, is fictitious, but his story is true—taken from the files of a leading auto maker. His is not an isolated case. Each year, thousands of car and truck buyers appeal to the factories when dealers are either unwilling or unable to correct defects in new vehicles.

In today's highly competitive market, manufacturers are expanding their owner-relations programs, recognizing that a backlog of satisfied customers is their greatest asset. Some even invite selected groups of owners to dinner at a local hotel or restaurant to get firsthand product information. Owners are asked why they bought a particular make and model and what they like and dislike about it. They are encouraged to air compliments and complaints.

Try the dealer first. Before contacting the manufacturer, give the dealer a chance to correct your complaint. Most dealers would rather satisfy an unhappy customer than explain to the factory's zone manager why they didn't. Don't accept a brush-off from the service man-

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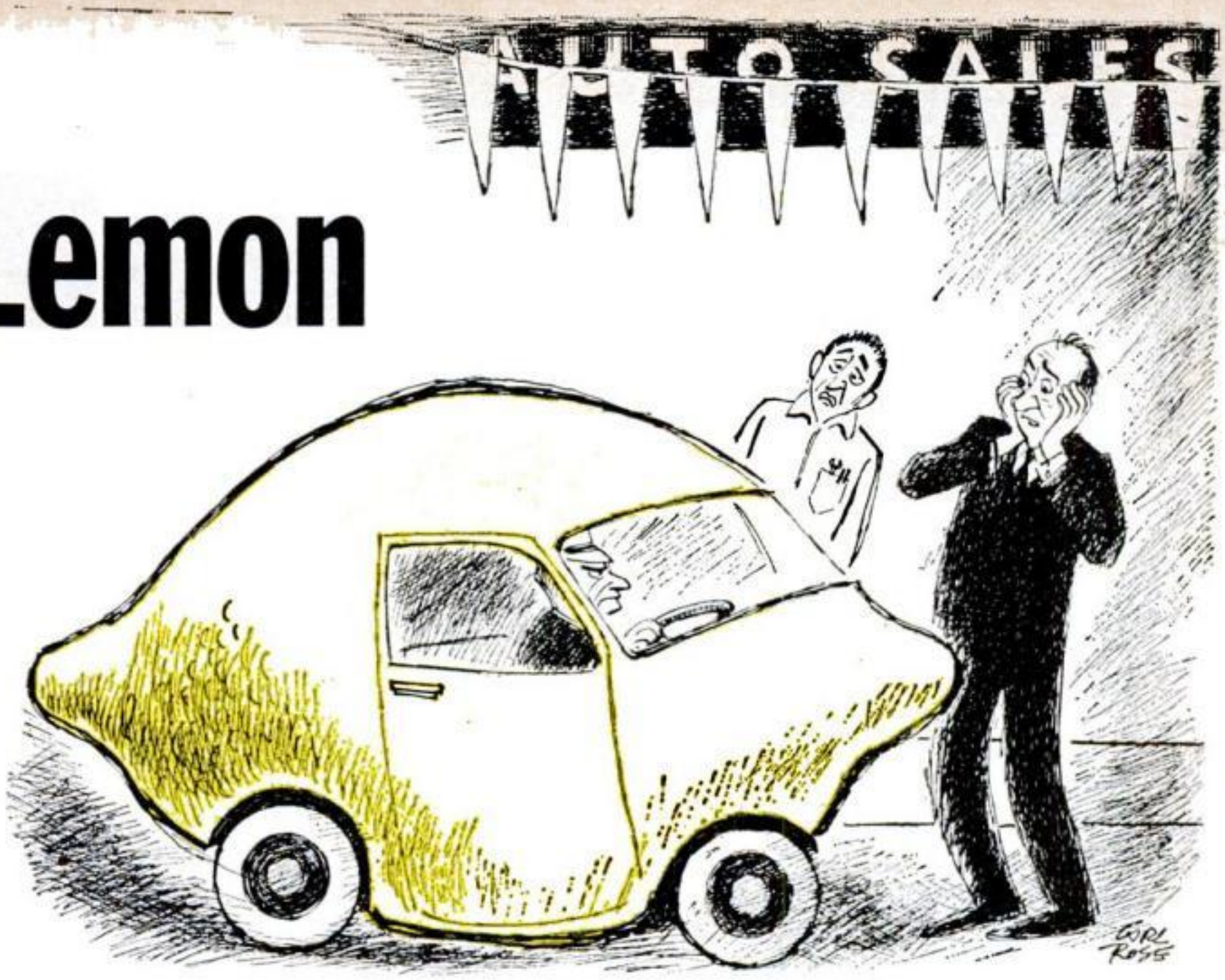
Lemon



Will driving a lemon to your dealer and raising a hoopla do any good? Maybe not.

ager as evidence that the dealer won't do anything about your problem. That harassed individual is expected to run the service department on a profitable basis. Unfortunately, there's a temptation to shunt unprofitable warranty repairs aside.

Even the most conscientious service manager is sometimes frustrated in his efforts to correct a complaint by the shortage of qualified mechanics.

Here's one customer's experience, as recorded on tape during a factory-sponsored owners' gripe session.

Many dealers have owner-relations managers to absorb the shock.

"I walked up to the mechanic and I said, 'Say, that engine's missing, isn't it?' And he said, 'No, sir, she's hitting on all of them.' And I said, 'I don't know how in the world it could be when the back wire back there is laying down there by the engine.' And he said, 'Well, by golly, it is, isn't it?' "

Realizing that service managers cannot satisfy all complaints, automobile manufacturers have persuaded many dealers to appoint owner-relations managers. The ORM's job is to discuss the customer's problem with him and arrive at a satisfactory solution. He's the man to see when you can't make headway with the service manager.

If the dealer has no owner-relations manager, take your troubles to the general manager or to the dealer himself. In a surprising number of cases, the problem seems to solve itself when it's brought to the attention of the right party.

Case of the Leaky Trunk. Sometimes a little prodding from the dealer or his

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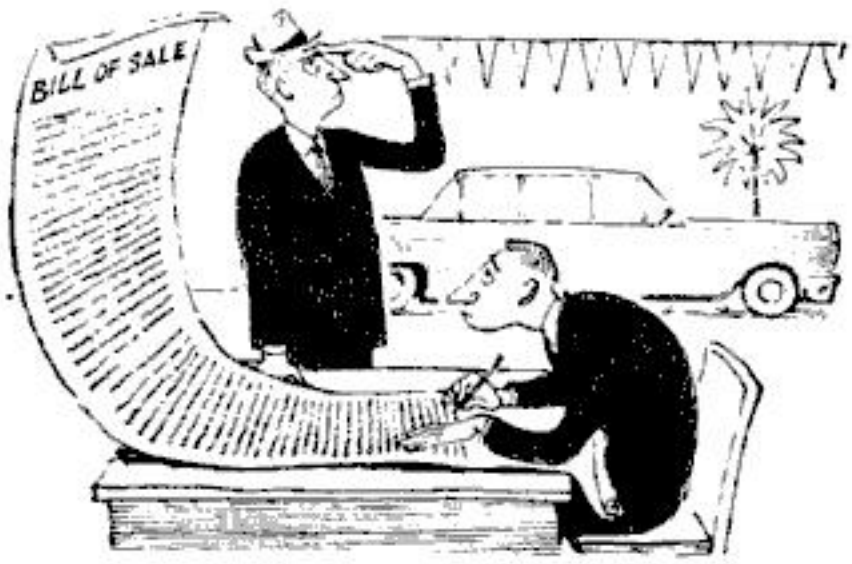
Urheberrechtlich geschütztes Material

owner-relations manager is necessary before a reluctant service manager will ask for technical assistance from the nearest factory zone. In one recent case, an owner brought his new car into the dealer's service department five times in futile attempts to stop water leaks in the trunk. Finally, a factory service representative was called in. He found that the leak was actually at the rear-window weather strip, helped the dealer's mechanic seal the area, and authorized the replacement of water-stained luggage-compartment mats.

If you have reached an impasse with the dealer, the manufacturer wants to know about it. Each company maintains local offices. In some cases, these are



No oral agreements. Insist that all equipment be listed on the order.

listed in your owner's manual. If not, get the address from the dealer.

At this point, a little self-restraint will prevent embarrassment. Don't tell the dealer you'll never set foot in his place again. Car factories mostly insist that a complaint be satisfied by the dealer who sold the car. It's a good bet you'll find yourself back at that same dealer, discussing your problems with a factory representative.

Be specific. Although manufacturers' field setups differ, each zone office usually has its own customer-relations manager. Give him all the facts, including the year, model, and serial number of your car, date of purchase, mileage, and the dealer's name. Make your complaints specific: "Transmission fails to shift when cold" is less colorful but a lot more helpful than "Transmission is lousy."

While complaints can be registered by a telephone call or a personal visit to the zone office, there's less chance of misunderstanding when all the information is put in a letter.

Most complaints can be handled in the zone, district, or region, but factory officials admit (off the record) that nothing gets as much action as a letter to the top brass. If the letter indicates an engineering or production goof, or gross mishandling by the dealer, the boss wants to know why.

The zone follows through on the complaint, even though it may have been received at the home office. The customer-relations manager contacts the dealer. One car factory reports that of 31,995 complaints received in the first six months of 1964, all but 1,568 were settled at this stage.

These quick results reflect the fact that many complaints reach the factory due to misunderstanding on the part of the dealer. If he's doubtful that a specific repair is covered by warranty, he may stall until the customer loses patience and complains to the factory. In such cases, the problem is usually solved as soon as a factory man assures the dealer he will be reimbursed.

Keeping up with the bulletins. A dealer service manager who gets behind in his reading of factory bulletins can also be responsible for customer dissatisfaction. One recent car model was plagued by hesitation and stalling on acceleration. After the dealer failed to correct the trouble, a disgruntled owner wrote to the factory. A company representative referred the dealer service manager to a bulletin, which told how to modify the accelerating pump.

Sometimes the factory service representative has to explain the facts to the owner, as tactfully as possible. One influential citizen complained that the wheels of his high-priced car were out

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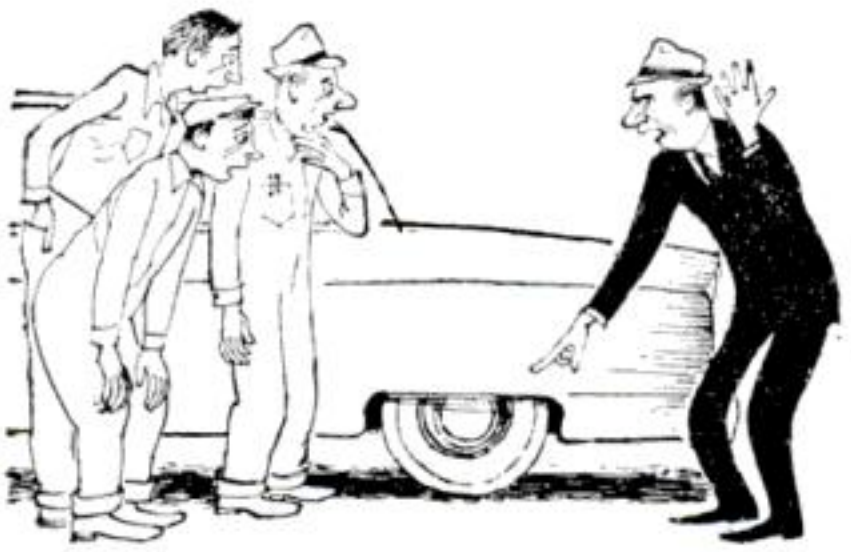
of balance. The dealer balanced them free. But when the owner spotted the wheel weights, he objected to their appearance and wrote to the company demanding a set of perfectly balanced tires.

At the request of a factory official, the customer and his chauffeur met with a service representative, who soon convinced them that compared with the odds against finding four such tires, plus an equal number of wheels and brake drums, breaking the bank at Monte Carlo was a sure thing.

If you're still unhappy after the zone service representative has taken a crack at your problem, you can appeal to the home office, which might have some technical information that has not yet reached the field forces. There's also the chance that, while the top man can't break factory policy, he might bend it a little.

A new car? Almost never. Once you've convinced the factory that you have a valid complaint, what sort of adjustment can you expect? Most car owners have heard stories about friends of friends whose complaints were so long and loud they were given a new car to keep them quiet. When questioned as to their policy of replacing an automobile, manufacturers gave replies ranging from "Never," to "Hardly ever."

Car makers take the view that virtually any defect can be repaired. An exception that nobody likes to discuss



One customer demanded a complete set of perfectly balanced tires!

When the owner pressed the button, he was greeted only by a deluge.

is the car that is badly damaged in an accident resulting from mechanical failure. A few years ago, a new-car owner suddenly found himself gripping a steering wheel that was no longer connected to anything. His car came to rest after wiping out the pump island of a service station. The manufacturer paid for the damage, picked up the hospital bill, and gave him a new car.

On rare occasions, a dealer will replace a car for a valued customer. A businessman who had been buying cars and trucks from the same dealership for many years bought the most expensive model in the line. Before he had driven 25 miles, the engine lost its oil pressure and seized. The dealer promptly replaced the car with a new one.

The policy of repair, rather than replacement, applies to major components, as well as complete vehicles. Should a cylinder block crack, for example, the usual procedure is to transfer all undamaged parts to a new block, rather than install a complete engine assembly. The entire engine is replaced only when it is more economical to do so. Under the terms of the new-car warranty, the manufacturer promises to replace only those parts that are defective in material or workmanship. The warranty does not cover such wear-vulnerable components as spark plugs, distributor points, or brake lining. These are replaced only if they fail prematurely because of defects in related parts. When the right-rear brake lining of one 1964 wagon wore

[Continued on page 190]

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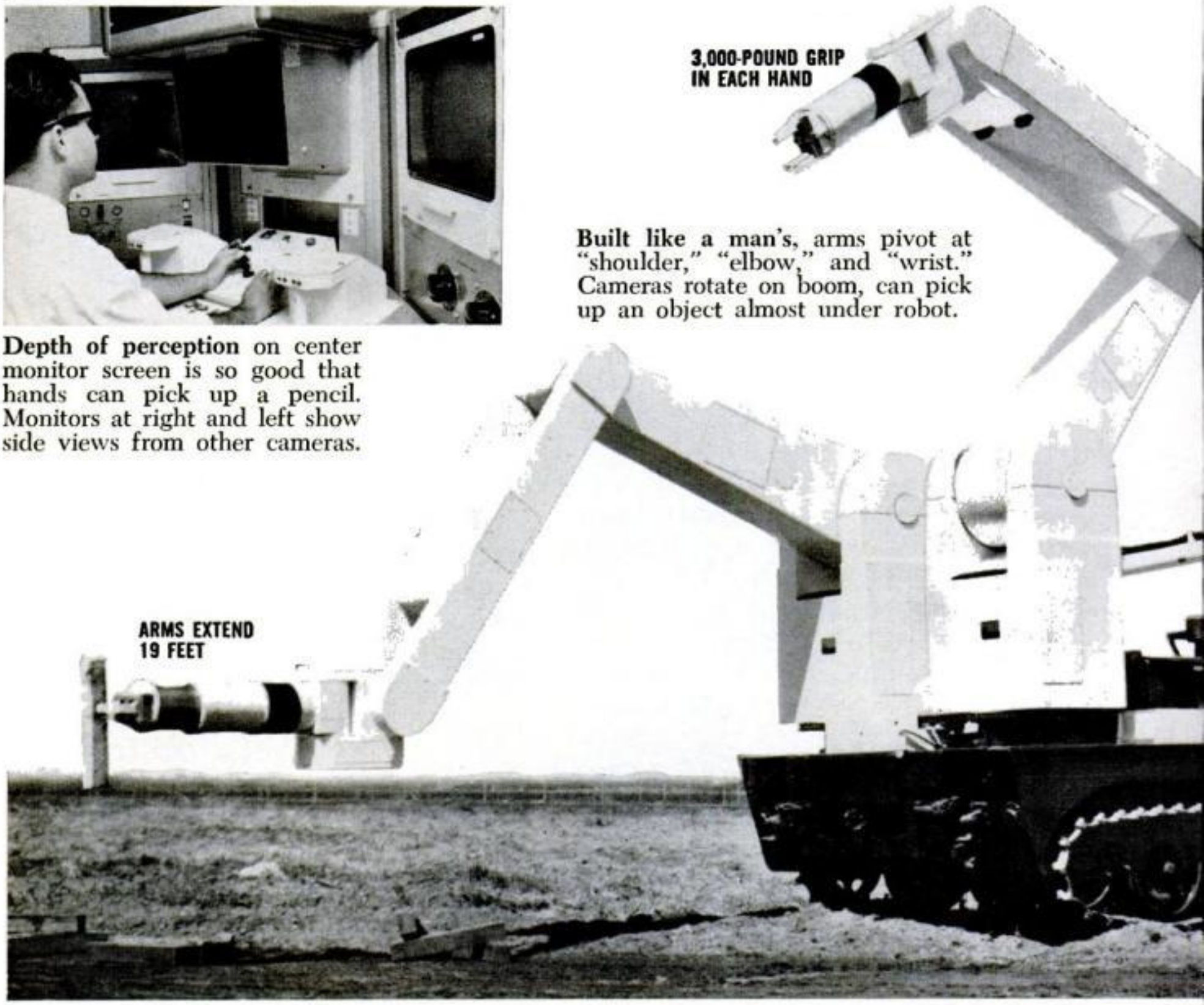
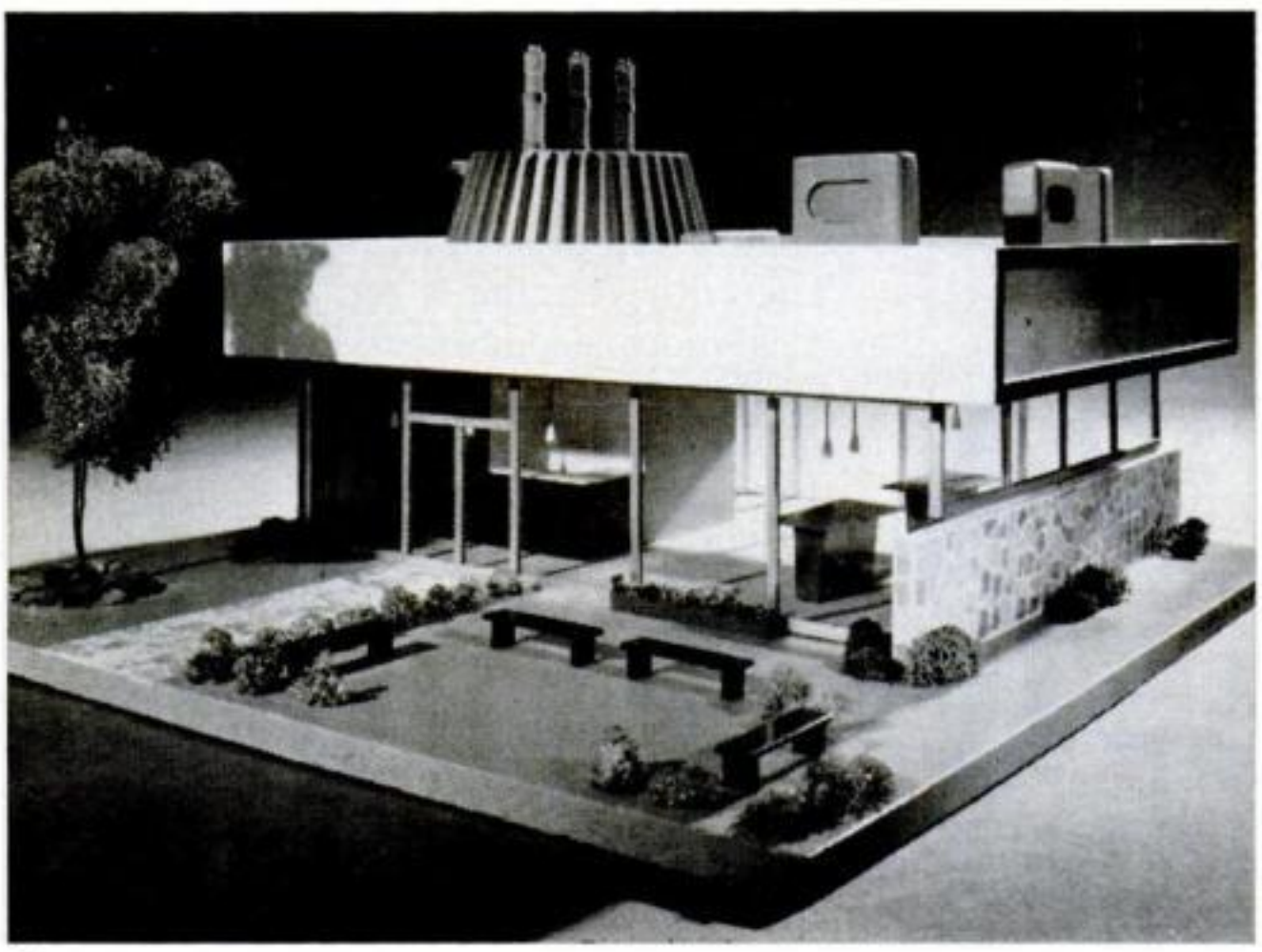
Depth of perception on center monitor screen is so good that hands can pick up a pencil. Monitors at right and left show side views from other cameras.

3,000-POUND GRIP IN EACH HAND

Built like a man's, arms pivot at "shoulder," "elbow," and "wrist." Cameras rotate on boom, can pick up an object almost under robot.

ARMS EXTEND 19 FEET





Power substation styled for suburbs

Designed to resemble a suburban clubhouse, the model at left is a proposal to give class to the usual unattractive electrical substation. Power-carrying equipment is enclosed and isolated safely on the roof. The rest of the building can serve as a field office or for community meetings.

The design is one of several proposed by U. S. Steel to help make power companies good neighbors.

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Robot mechanic has 3-D television eyes

Focusing with 3-D television eyes, this Air Force remote-control robot can pick up a bazooka and break it into scrap. Working with tools, it can repair a power line or disabled vehicle in a radioactive area without fear of fallout.

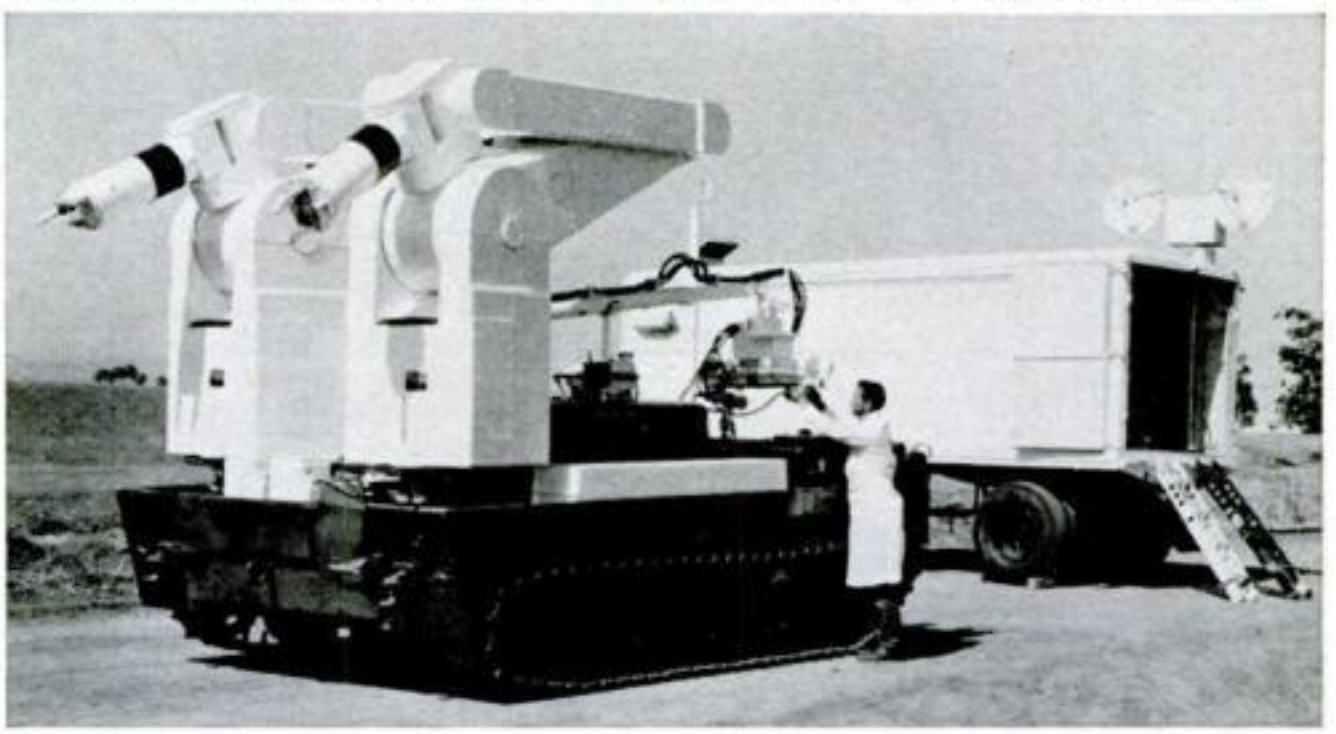
Its powerful hands have a 3,000-pound grip, enough to crush concrete, yet they are so dexterous they can pick up a pencil, turn bolts, handle a cutting torch, or work with power or hand tools.

The operator in a control van a mile away can move the arms—extend, retract, twist, and turn them—and manipulate the hands to perform the roughest or most delicate tasks. He can make repairs or destroy an enemy's men and equipment. Each arm can lift a 600-pound weight.

Manned, the 200-hp. vehicle can go 40 m.p.h. Radio-controlled, it does 10 m.p.h. Its tracks can move through rough country, climb a 60-percent grade, or negotiate a 30-percent side slope without upset.

FMC Corp. built the robot for the Air Force. Lenkurt Electric and Cohu Electronics developed its microwave TV system.

Radio control of tracked robot is from van at right. From mile away, operator at console can set speed, govern action, manipulate hands.



Big jet transport lands on soft field

Re-equipped with high-flotation landing gear and twice the usual number of wheels, a heavy 707 jet taxies here on dust and silt after landing on a dry lake bed in California. Boeing put 20 wheels on the special landing gear and inflated the tires to only 25 pounds to demonstrate to the Air Force how big military jets could fly troops and cargo to parts of the world where there are no long paved runways.

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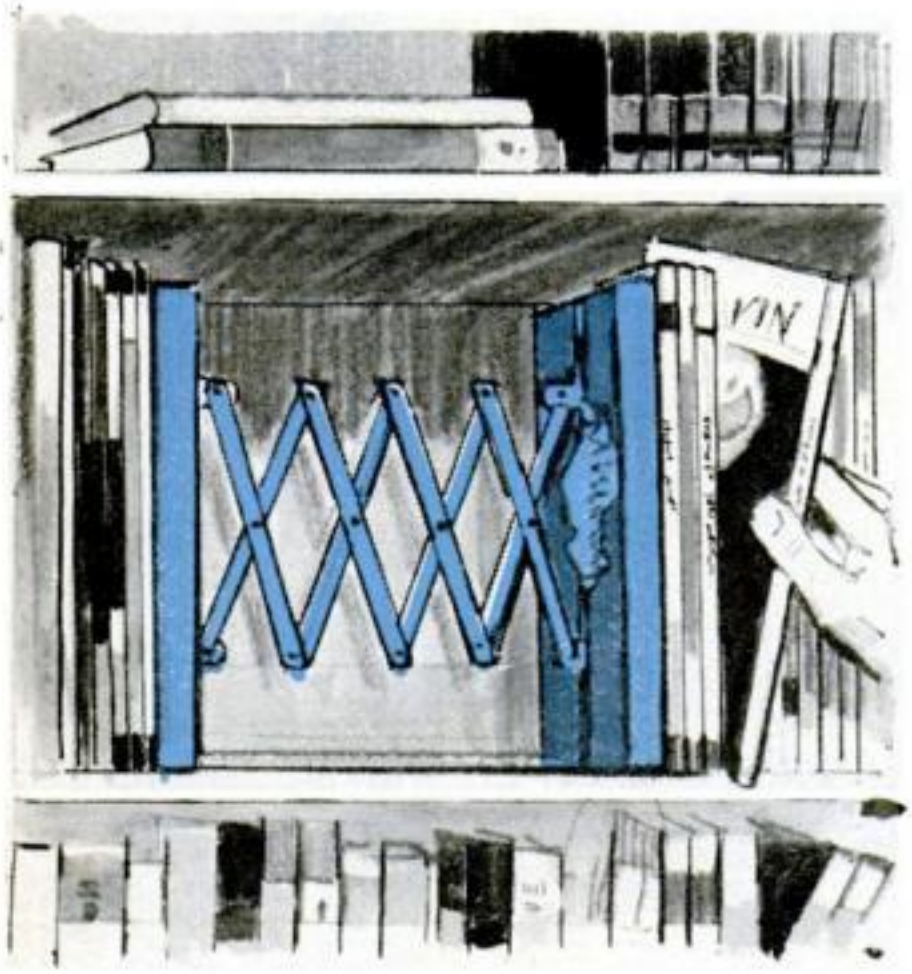
New Ideas from the Inventors

Pedal turns music pages. A musician could flip the pages of his score without using his hands if he had this recently patented rack. Long pins, carried by disks tracking in the base, would engage the pages in order. When the player touched a foot switch, a battery motor would move pin and disk—and page—from one side to the other around the curved center of the track.



Spring shelf holds records. Placed in the center of a record—or book—shelf, this spring-extended support would expand or compress to hold the stack upright. Slots in the endpieces would engage end lugs of the lazy tongs; a spring in each slot would normally contract the lugs to press the ends constantly outward.

Split lenses block glare. A driver wearing these glasses could reduce headlight glare just by lifting and turning his head. Tinted glass (or a tinted coating) would cut glare through the lower half of the left lens and a quarter of the right one. With his head up, as a car approached, a driver could clearly see the right side of the road.

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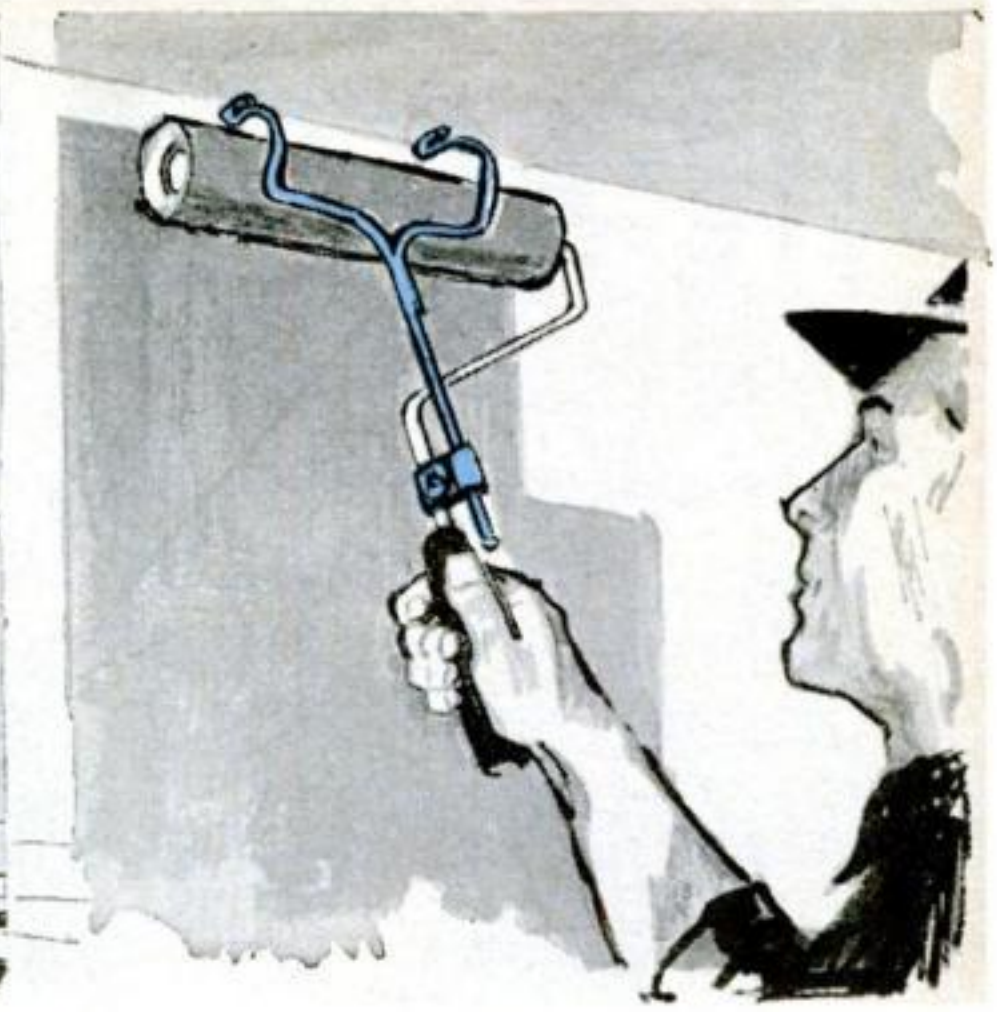
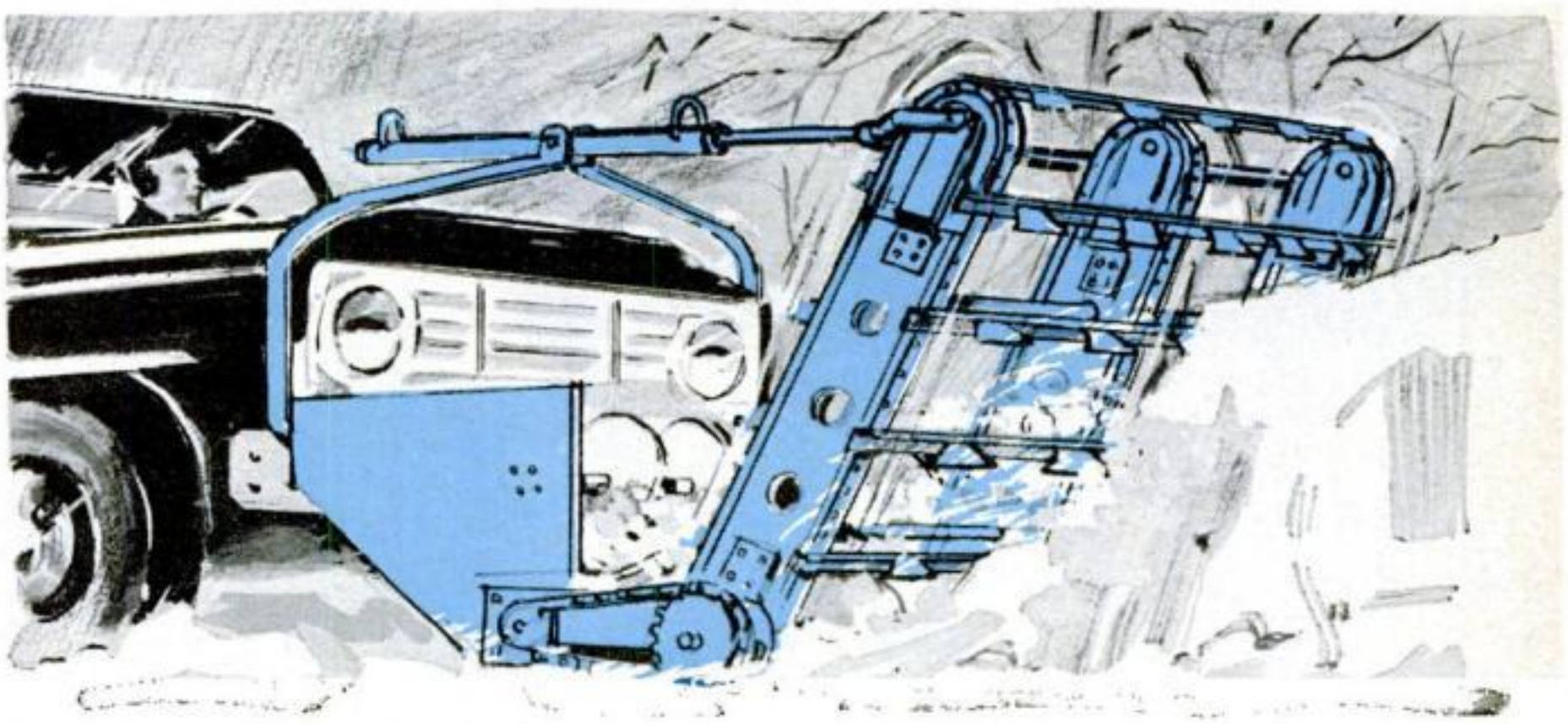
Umbrella forms its own stand. Opened outward to form a tripod stand, these riblike umbrella extensions would let a closed umbrella drain. The legs could also be folded inward for normal storage. When the umbrella was opened, the rubber-tipped legs would lie flat against the stretched fabric so you would hardly notice them.



Feeler protects painted surface. Bent-wire feelers on this roller would let you work close to an already painted or papered surface without worrying about getting unwanted paint on it. A thumbscrew adjustment would let you set the feelers to a short but safe distance from the wall or angle you want to protect from the smears.



Snowplow cuts ice. Attached to the front of a truck-mounted snowplow, this cutter would clear a path for the truck by chipping down ice or high drifts and feeding a manageable flow into an auger-type snow thrower. The attachment could be angled into the bank so you'd get the best action from the chain-driven cutters.

The following patents have been issued on these inventions: **Page turner**—*No. 3,064,518 to Peter M. Chernishenko, Virgil, Ont., Can.;* **Record holder** — *No. 3,124,252 to Eugene F. Canham, Coolidget, Ariz.;* **Driving glasses**—*No. 3,111,675 to Antonio Mora, NYC;* **Umbrella stand**—*No. 3,091,249 to Rose M. O'Neil, Lowell, Mass.;* **Paint guard**—*No. 3,088,152 to George Lucas, Tallmadge, Ohio;* **Ice chipper**— *No. 3,081,565 to Richard O. Varnum, Fort Klamath, Ore.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C., 20231, at 25 cents each. To write to an inventor, if the address given above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

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Are They Listening In

Don't say a word until you've checked the picture frames, the telephone, and the crevices in the woodwork. Little electronic devices have big ears

The extra man in the room is this electronic snooper, with his hidden mikes and taps. The gadgets let him listen in on everything that's said, whether he's next door or miles away in a car.

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on You?

By E. D. Fales Jr.

NEXT time you dicker for a car, be careful what you say when the salesman "steps out of the room" to let you mull it over. He may be listening with a hidden mike to every word you say to your companion.

Today the businessman you visit, or the salesman who calls on you, may be wearing a body mike or have a recorder hidden in a briefcase. Your conversation may be secretly "stolen" from you and played back later. This may be done for political purposes, to embarrass you with the boss, or as part of a "fishing expedition" for evidence (as in a divorce action).

You can be a victim of electronic snooping when you call your lawyer, the police, banks, or government agencies. In fact, as an average telephone user, the odds are that someone already has your voice on record.

Electronic snooping is mushrooming. More people than ever use illegal wiretaps and "bugs." Government agencies use them to catch criminals. Private individuals and some businesses use them to get the edge on competition, for plain "fun," or even for blackmail.

AT Washington National Airport, not long ago, control-tower operators began hearing strange voices on the radio. The Federal Communications Commission was notified and promptly put tracer cars on the case. They discovered the mysterious source—a hotel room, five miles away. There two men were talking business, not dreaming that a tiny hidden radio was broadcasting every word.

In a nearby room, the FCC men found the talk being recorded by three "private eyes." All were arrested.

There are thousands of full-time wiretappers and buggers like them. Only a few are legitimate law-enforcement agents on the trail of criminals and armed with court orders. The majority are police operating illegally, private eyes, blackmailers, employers, political spies—or just busybodies.

HERE'S the weird arsenal of electronic devices they use:

The big ear. A snooper can aim this inexpensive gadget at a neighbor's open window, at an outdoor group chatting on a patio, a foursome of golfers, a competitor's business place, and hear everything within 400-foot range. He can even plug in a tape recorder.

The teacher trap. Some school kids now use an inexpensive tape recorder, hidden in a pocket.

"I could get our physics teacher's license taken away tomorrow if I wanted to," one Midwest high-school student told POPULAR SCIENCE. "He jokes with us in class and I've recorded a lot of things he's said that the Board of Education wouldn't like. But why be mean?"

The principal, too, can eavesdrop, via hidden microphones in the public-address system, on any classroom without knowledge of teacher or pupils. This is done "to be sure the teacher says the right thing."

Talkie pictures. Snoopers can buy a nice, ordinary-looking framed picture. No

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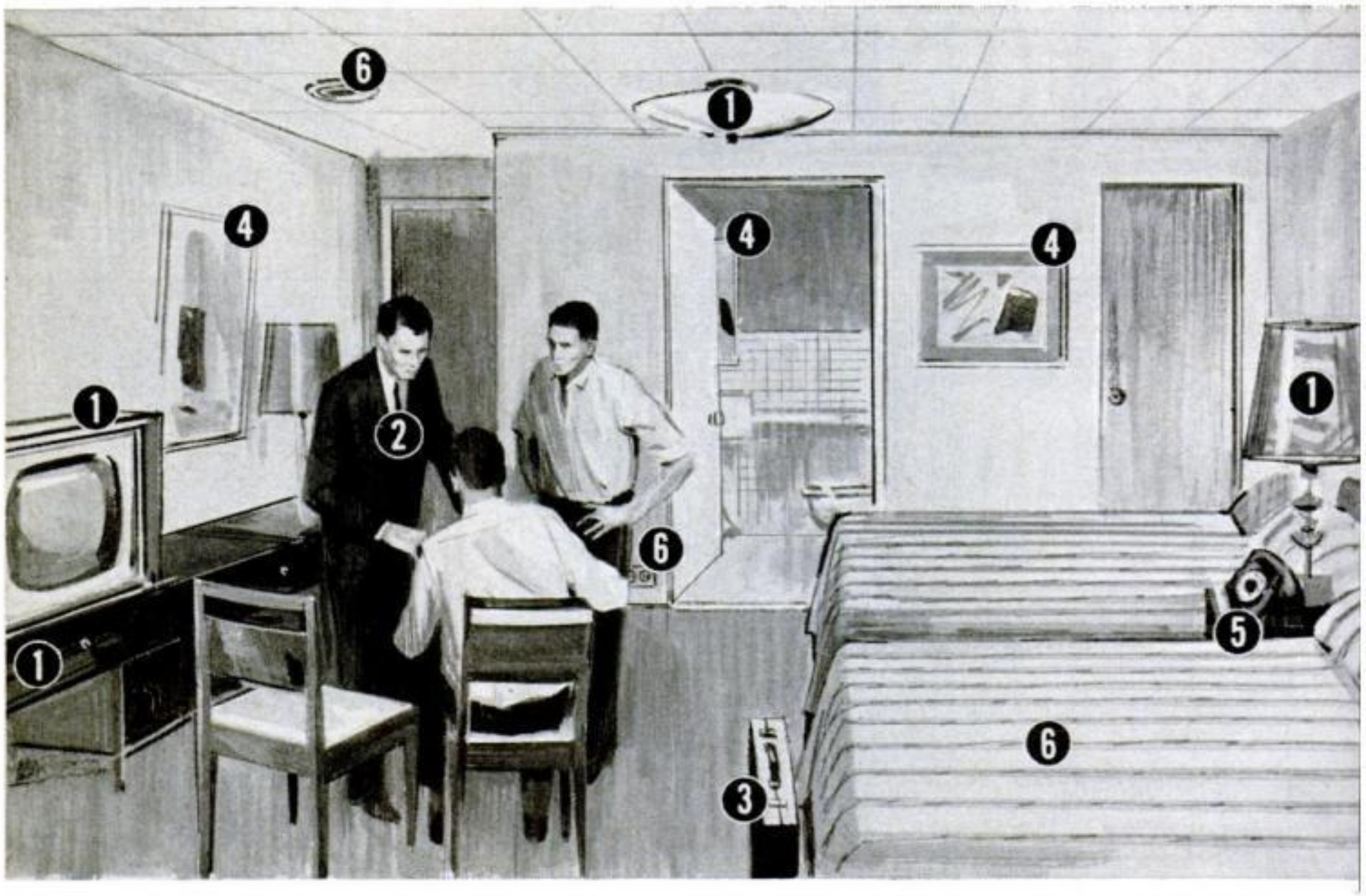
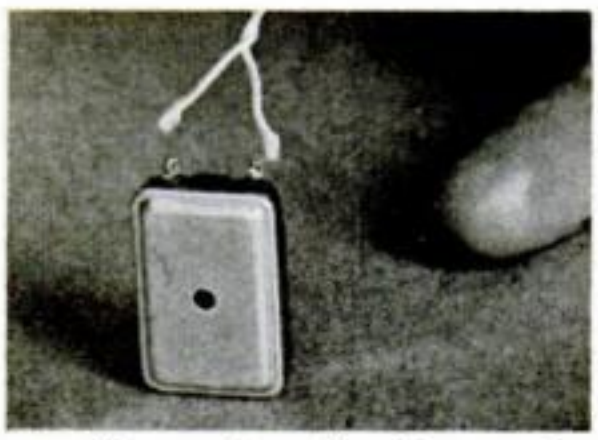
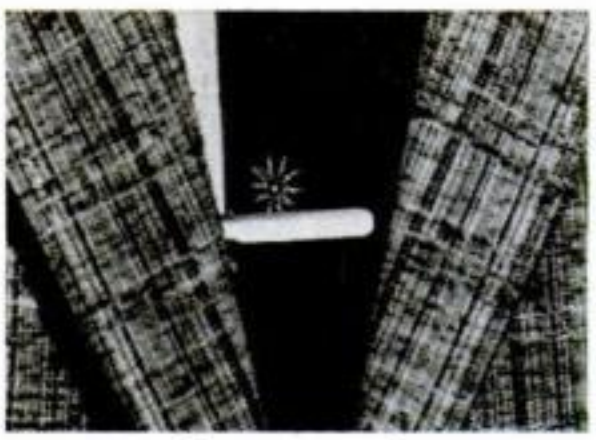
Where buggers and tappers plant their sneaky gadgets





❶ **"Sugar-lump" mike** can be concealed anywhere. Invisible connecting wires may even be painted to transmitter.



❷ **Tie-clip microphone** may be used by business associate to tape and use your own words against you months later.

❸ **Attaché case** holds a battery-operated miniature tape recorder that plugs into a receiver and records for up to one hour.

one would ever suspect that its frame contains a tiny mike that is a broadcasting station.

The picture can pick up your most casual comments and transmit them to a parked car a block away.

"Sugar-lump" mikes. These tiny devices can be hidden in drapes, lamps, flowerpots, or even TV sets.

Cigarettes that "hear." A snooper may offer you a cigarette, then put the pack (and the transmitter you didn't notice in it) back in his pocket. Your conversation is broadcast to a hidden confederate up to 1,200 feet away.

The bugged man. There's a little wire recorder that goes under the snooper's shirt. The mike is in a wristwatch, tie clasp, or pen.

Hairy "ears." These devices include a wire so thin you can't see it when it's varnished into the woodwork. It can be connected to a mike hidden in a wall.

The "spike." Another gimmick is the "snooper's spike," a 12-inch steel nail that can be attached to a tiny mike

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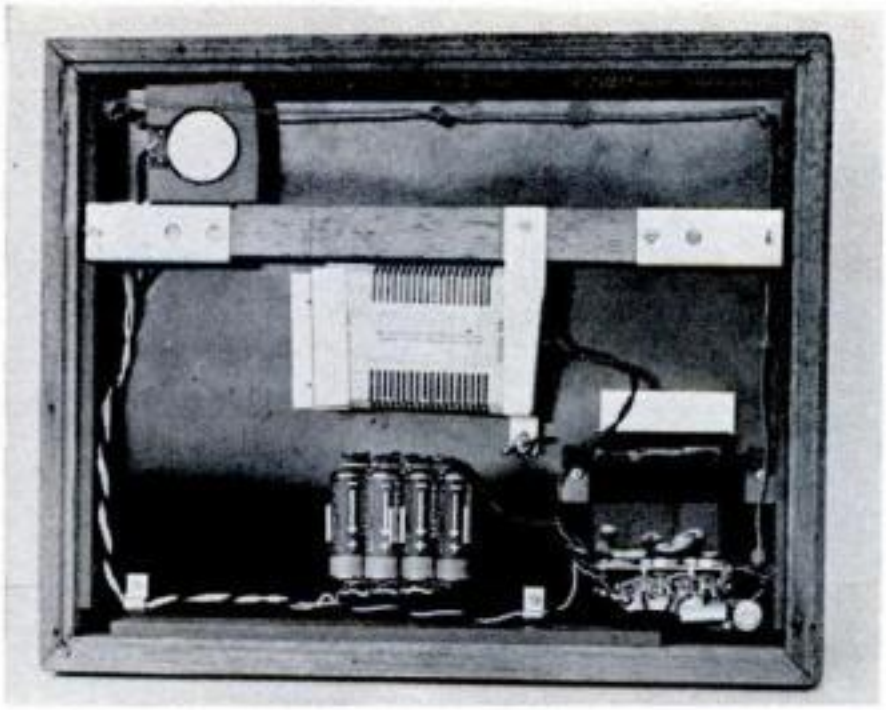
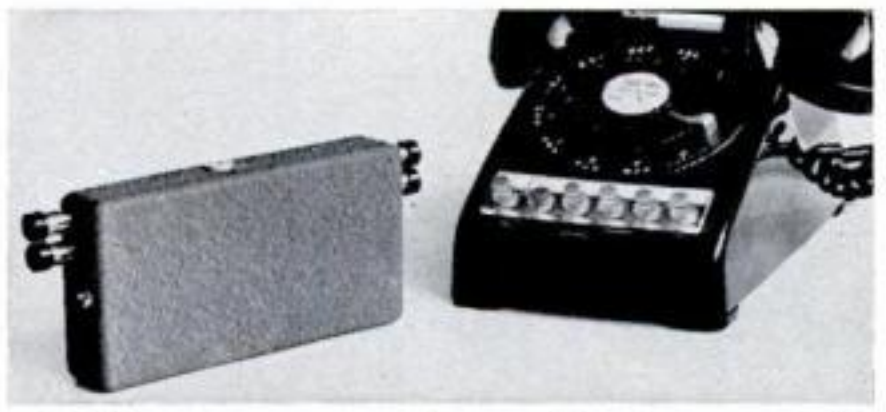


4 **Picture frame** hides a self-contained battery broadcasting station that relays all talk within a room for hundreds of hours.



5 **Phone tapper** needs no wires to remote listening post. It hooks in anywhere on the line—is on only when phone is off the hook.

6 **Tiny transmitter** (2⅞ by 3½ by 1¼ inches) can be hidden anywhere. Its battery pack provides up to 200 hours of continuous service.

hooked to an amplifying circuit. The snooper drives it against a pipe system or, best of all, a metal heating duct behind a baseboard. It picks up everything said from basement to bedroom.

In some cities snoopers don't even bother with wiretapping. They merely bribe someone in the phone exchange to pipe your calls into their lines.

New wonders. Recently the communists bugged our Moscow embassy by aiming a beam at a tiny reflector embedded in our Great Seal itself. Today we, too, are developing such devices—using microwave, ultrasonic, and even laser beams.

If a room is silent, a microwave beam will bounce back unchanged from any reflector. But if people are talking, the reflector vibrates and the return beam is changed, or modulated. Words spoken in the room now can be read off the beam by suitable receivers.

Snoopers using laser and microwave devices no longer need wiretaps. "I can sit in this car now," one told me, "and pick up a conversation from any window we can see." Sometimes the window itself, or a door, can be used as a vibrating reflector.

All this might be considered merely freakish or funny—if electronic eavesdropping had not suddenly become a threat to individual privacy.

Investigators recently reported finding microphones hidden in the toilet-paper rollers in one company's washrooms. A so-called "security man"—current term for company detective—could, by throwing a switch, monitor 10 toilets at will.

Yet all this is legal in most states. No law forbids a man to record your voice without permission—except for one federal law about telephone wires. This statute has been violated by police and federal agencies so often that they are reluctant to jail private individuals who do it.

In one of the few arrests made since wholesale eavesdropping began, a prosecuting attorney was arrested on a charge of using tape-recorded conversations in a blackmail attempt. In another recent case, a county official in a southern state was arrested for tapping his employees' phones—as hundreds or even thousands of U.S. companies now do, often with the help of telephone-company employees.

Congressional investigators have heard that as many as 5,500 "snooper buttons" have been used by federal employees in Washington, D.C. A snooper button lets an employee record your voice when you call a federal agency. Some use regular

[*Continued on page 186*]

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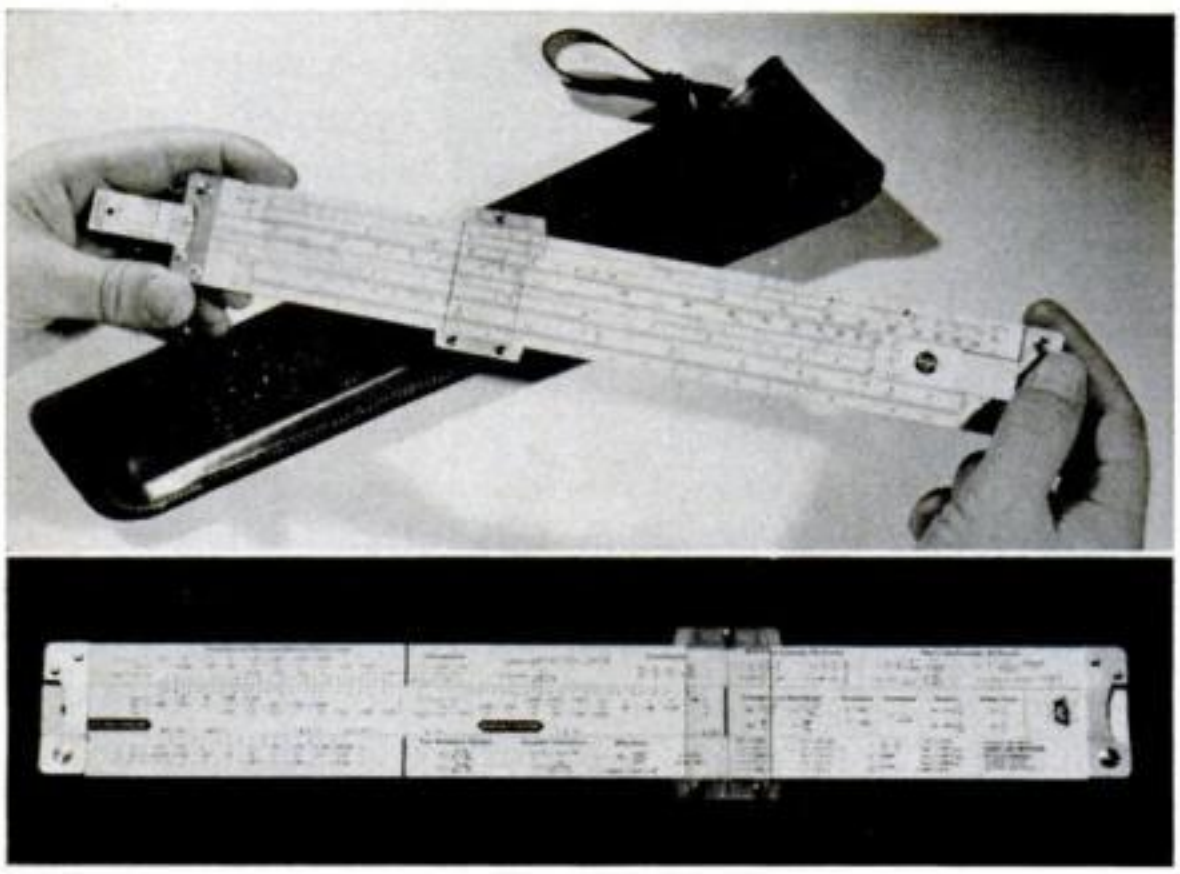
Transistorized unit improves CB gear

Boost the performance of your mobile Citizens Band transceiver by replacing its power-supply vibrator with this solid-state substitute. Installation is simple: Just plug the eliminator into the vibrator socket. The transistorized unit doesn't generate "vibrator hash," so it reduces receiver noise level. It cuts battery drain, too, since it is more efficient than a mechanical vibrator. Price: $5.95. I.E.H. Mfg. Co., NYC.

It Works When Phone Rings

THAT device you see under the telephone (above) contains a locking relay circuit that goes into action when the telephone rings. It turns on a neon pilot lamp, or will operate any other electrical equipment plugged into a socket on the back. The equipment stays on until you press a reset button. You can use it to turn on a lamp so you don't stumble around a dark room to answer the phone; ring a remote bell to signal that your phone is ringing when you are in a distant room; turn on your house lights at dusk on evenings when you're away from home (just dial your own phone number). Price: $39.95. Ted Michaels Co., 400 S. State St., Chicago.



Slide rule is scaled to solve electronic problems

This all-metal slide rule has two unique scales that give you answers to typical reactance and resistance problems in one or two steps. With conventional slide rules you must work through three or four manipulations. On the back, there is a table of commonly used electronic formulas, and a handy decimal-point locator. Price, with case and instruction manual: $14.95. Cleveland Institute of Electronics, Cleveland 14.

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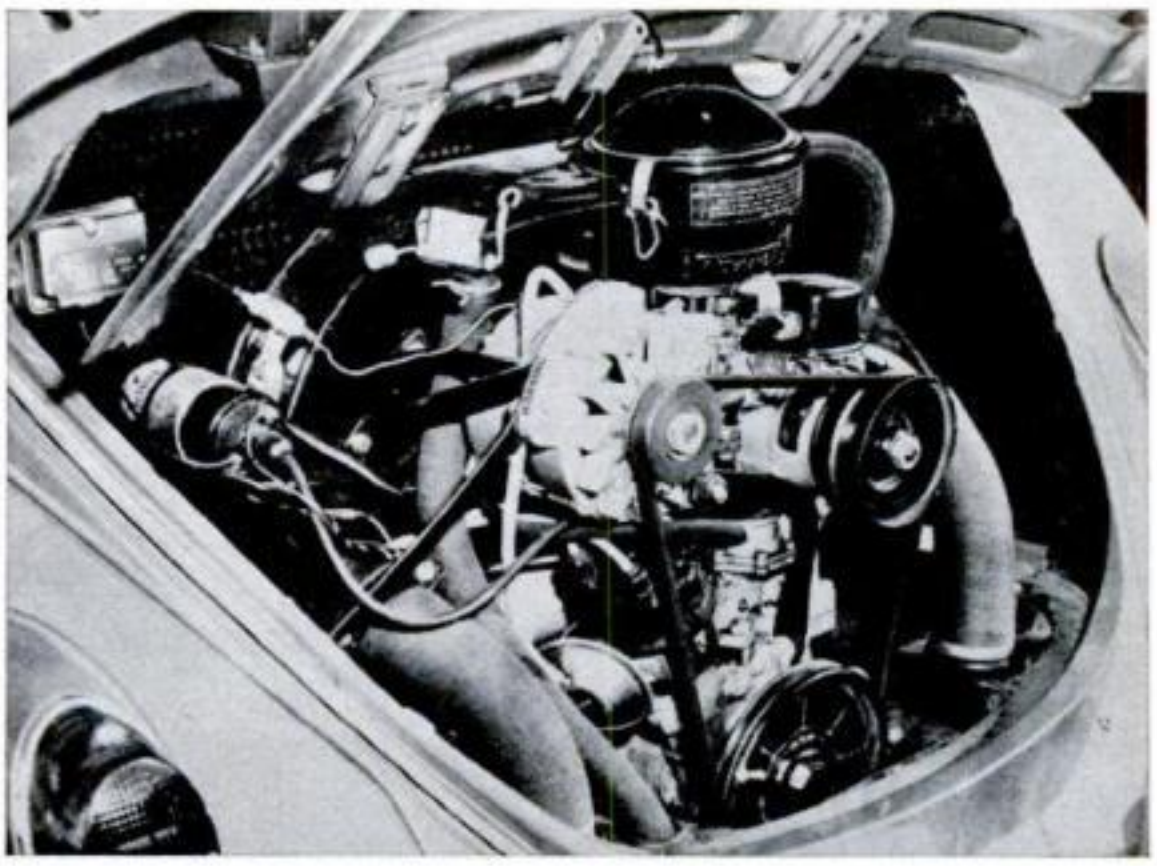
Plug-In Vacuum Cleaner

AT LONG last somebody has made a plug-in, 12-volt car vacuum cleaner that really does the job. Sport-Vac weighs only five pounds, yet will pick sand off rubber mats or out of the carpet. It does an effective job on cloth upholstery, and there's a crevice nozzle for cleaning between seat backs and bottoms. Dust and dirt is sucked into a disposable paper bag. Hose and parts store inside a case for travel. The blower will inflate an air mattress. About $30. Thomas Edlyn Co., Box 362, Collingdale, Pa.

Alternator kit provides 12-volt power for VWs

A 12-volt alternator system in convenient kit form has just been introduced. Called the RM 12V Pak, the kit consists of an alternator, mounting brackets, fan-belt, and wiring. It fits all models, does not interfere with standard six-volt system. About $110. RM 12V Pak, 767 Minot Ave., Auburn, Me.



Meter shows condition of battery and generator

A new single-dial meter continuously shows the condition of your battery and generator, and the operation of your voltage regulator. Not a conventional ammeter, the device shows the amount of charge in the battery itself when the engine is not running—without drawing voltage from it. When the engine is started, the indicator needle swings into the charging area to show the exact amount of charge going to the battery. Chargicator sells for $17. Imperial Products, Ltd., 248 Jericho Turnpike, Bellrose, N.Y.

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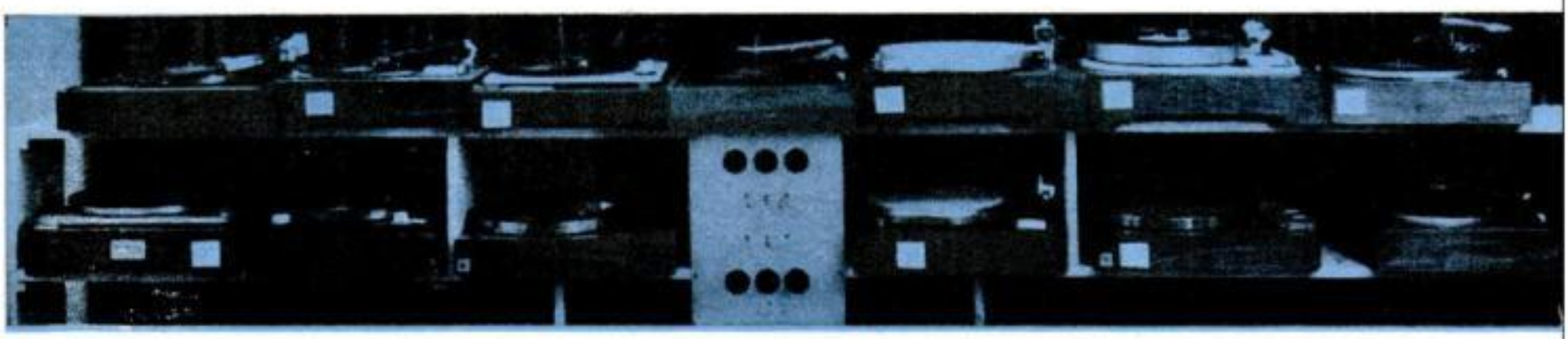
A's to Your Q's About



Confused about stereo? So are a lot of "experts." Here are straight answers that'll save you money and disappointment

By Hans Fantel

STEREO is getting to be a regular household item. And yet, there's more confusion about stereo than about any other home appliance. Even radio technicians often know too many things about stereo that just "ain't so," and salesmen often know nothing at all. With so many in a fog, it takes basic questions to cut through to facts.

Q ***What does stereo do for music?***

A Suppose you're at a concert. Even with your eyes closed, you sense the location of the players: fiddles left front, brasses right rear, etc. Stereo keeps this sense of direction when you listen at home. What's more, it transplants the acoustics of the concert hall into your living room. Even if your own room is small, you get the illusion of being in a large hall—if that's where the music was originally recorded.

Q ***Does stereo guarantee natural sound?***

A No. Stereo varies all the way from superb to miserable, depending on the quality of your equipment. Portable sets, for instance, are usually bass-shy, and many cheap models sound shrill and distorted. If stereo is to be any good, it must first of all satisfy basic high-fidelity standards: wide-range frequency response and low distortion.

Q ***Is stereo better than hi-fi?***

A That's like asking whether a convertible is better than a car. Stereo isn't a substitute for hi-fi. It's an extra value added to high fidelity—a second channel that provides depth and direction.

Q ***Do I have to sit right smack in the middle between the two speakers in order to get the best stereo effect?***

A You get the most balanced impression of the orchestra when you are halfway between left and right speakers. But you'll notice the stereo effect almost anywhere in the room. Walking across a room filled with stereo sound is like dancing across the ballroom floor in front of the bandstand. You get a different sound at various points, depending on

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STEREO

which instruments you're closest to. But this only adds to the realism.

Q ***Can I get stereo by hooking a second speaker to my hi-fi?***

A No. Both speakers would be playing exactly the same thing because you'd connect them to the same amplifier output. To get the stereo effect, you need completely separate sound channels to emphasize the *difference* between left and right.

Q ***Can I play my old mono records on my new stereo rig?***

A You bet. A stereo cartridge will play any LP or 45-r.p.m. record—mono or stereo. The only records it won't play are old 78 discs. They're cut with wider grooves and you need a special stylus with a 3/1,000-inch (3-mil) tip diameter to play those oldies.

Q ***What happens if I play stereo records on a nonstereo phonograph?***

A You'll ruin the record. The old mono stylus swings only from side to side. It can't follow the vertical wiggles in the stereo groove. So it digs into the disc and rips up the record. You can't see the damage, but you sure can hear it. After a few spins on a mono rig, a stereo record sounds as raspy as sandpaper when played later on a stereo machine.

Q ***How do they get the left and right channels into a single groove on stereo records?***

A One channel is recorded by horizontal swings in the groove, the other by vertical ups and downs. The stereo cartridge in your tone arm translates the combined vertical-plus-horizontal motion into separate signals for the left and right channels.

Q ***Does a 40-watt stereo system play twice as loud as a 20-watt system?***

A No. Double wattage doesn't mean double loudness, just as two people singing a duet don't sound twice as loud as a single person singing. Fact is, the loudness difference between a 20-watt and a 40-watt system playing at top volume is hardly noticeable.

Q ***Then what's the use of the extra power?***

A The big difference is clarity of sound. The heftier system has a bigger power reserve. At critical moments when the music demands a sudden power surge—crashing chords, drum beats, deep-rolling bass notes—the bigger am-

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plifier doesn't have to strain. Such "musical emergencies" may drive a low-power system to the brink of distortion.

Q ***Okay, then how much power do I really need?***

A Depends on the size of your room, the efficiency of your speakers, and how loud you like your music. In most cases, 20 watts per channel is plenty; but more power is handy (a) for a very large room with lots of sound-absorbing curtains and upholstery; (b) if you like big orchestras and like to play them loud; (c) if you have inefficient speakers—that is, speakers that gobble up a lot of watts to produce a given loudness. If a, b, and c all apply in your case, you'd better get a real powerhouse of an amplifier that puts out about 50 watts per channel. For the average room, 15 watts per channel (30 watts total output) is satisfactory.

Q ***Is an inefficient speaker bad?***

A Not necessarily. Efficiency in a speaker is no clue to quality. In fact, some of the best speakers made are quite inefficient. This merely means that they need plenty of watts to produce full volume—namely, a big amplifier with power to spare.

Q ***What's stereo going to cost me?***

A You can get a good basic system for about $150 if you pick your components carefully. For the best there is, you'll have to fork over upward of $700. For specific recommendations and prices, see POPULAR SCIENCE, September, 1963. If you want to add an FM stereo tuner (to get stereo off the air) check POPULAR SCIENCE, September, 1964, for the best buys.

Q ***In budgeting for a system, where will a few extra dollars do the most good?***

A Spend the extra bucks for better speakers. The speakers are the voice of your system—the only parts that actually generate sound. More than any other components, they determine the quality of what you hear.

Q ***Do all kinds of music sound better in stereo? What about a piano solo, a singer?***

A Even the solo sounds better in stereo because two-channel sound transmits more of the original studio acoustics. Of course, the stereo effect is not as great as for a large orchestra. It's surprising, though, how much stereo adds to the realism of even small groups, like a jazz combo or a string quartet.

Q ***Can a set that comes installed in a fancy cabinet be as good as one with individual components?***

A It's possible, but chances are against it. Most makers of console sets pay more attention to the box than to its electronic innards. They're selling furniture, not sound, and you take potluck with whatever the manufacturer puts inside. If you buy separate components, you can choose each item to meet your requirements in performance, features, looks, and price. Added drawback in console sets: Built-in speakers are usually too close together for optimum stereo.

Q ***Can I put together a kit and have as good a set as if I bought one factory-finished?***

A Some top-notch kits are identical in design with the best factory-built components. If you're handy with a soldering iron and follow the instructions carefully, you wind up with a system as good as any you can buy—and save up to 40 percent by doing your own assembly.

Q ***How do I know the left channel from the right?***

A Stereo signals come from the phono cartridge. Its output terminals are usu-

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ally marked "L" for left, and "R" for right. The leads from the cartridge to the amplifier are color-coded so you can tell the two channels apart. The "left" lead goes to the input marked "Channel A" on the amplifier; the "right" lead goes to the Channel B input. Same with loudspeaker connections: Channel A output goes to the left speaker, Channel B output goes to the right.

Q ***How do I find the proper distance between left and right speakers?***

A Spread out the speakers along the wall facing your favorite chair, first pushing them all the way into opposite corners. Ask a friend to push the speakers closer together—a little at a time—while you listen. When he reaches the point where you don't hear the two speakers as separate sound sources but the music seems to spread out *broadly* between the speakers—that's the optimum speaker placement. If you can't get a solid kind of sound seemingly coming from between the speakers, try turning the speakers on their backs, bouncing the sound off the ceiling.

Q ***What is meant by speaker phasing?***

A The two stereo speakers should be working in tandem, pushing and pulling the air at the same time. If one pushes while the other pulls, the speakers are out of phase and cancel each other out on the low notes. To make sure your speakers are in phase when you hook them up, ask a friend to reverse the connections at the rear of one speaker while you sit in your usual listening chair. The hookup that gives more bass is the correct one.

Q ***I see stereo tape recorders advertised as four-track models. Why four tracks when stereo only has two channels?***

A You don't use all four tracks simultaneously, just two at a time. First you record two tracks while the tape travels in a forward direction. Then you flip the tape reel over and record another two stereo tracks while the tape spins in reverse. Since you record in both directions—coming and going—you double the playing time per reel. Each pair of tracks is off-center relative to the width of the tape, so the tracks don't overlap when you flip the reel after the first run-through.

Q ***I've heard that compliance is the most important factor in a stereo cartridge. What's that?***

A Compliance is a measurement that tells how freely the stylus wiggles in the groove. What you may hear as a bright, shiny trumpet blast is, for the stylus, a wild ride on a bumpy road full of hairpin turns. All along this tricky ride the stylus must hug the road, following the musical wiggles as closely as possible. The higher the compliance, the more accurately the stylus follows the groove contour. Top cartridges today have excellent compliance ratings. Older cartridges are often stiff-jointed, rough-sounding, and ream out the grooves faster.

Q ***Do stereo records wear out faster than mono?***

A Depends on how you treat them. If you use a high-compliance cartridge tracking at less than two-three grams' pressure, stereo records last almost indefinitely. Of course, you have to sweep up the grooves with a record brush before every playing so no dust gets ground into the surface.

Q ***I can tell if a set is stereo, but how can I tell if it's high-fidelity?***

A Use your ears. They're the best test instrument ever made. But like any other instrument, you have to "calibrate" them. Go to a "live" concert (no mikes and no amplifiers) and try to remember the real sound of the instruments. Then compare the sound from your rig. ■■

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Wanted: 500,000 Men to

By Stanley L. Englebardt

IF YOU know how to "talk to computers," chances are you've got it made. If you don't, you may be missing out on a great job opportunity.

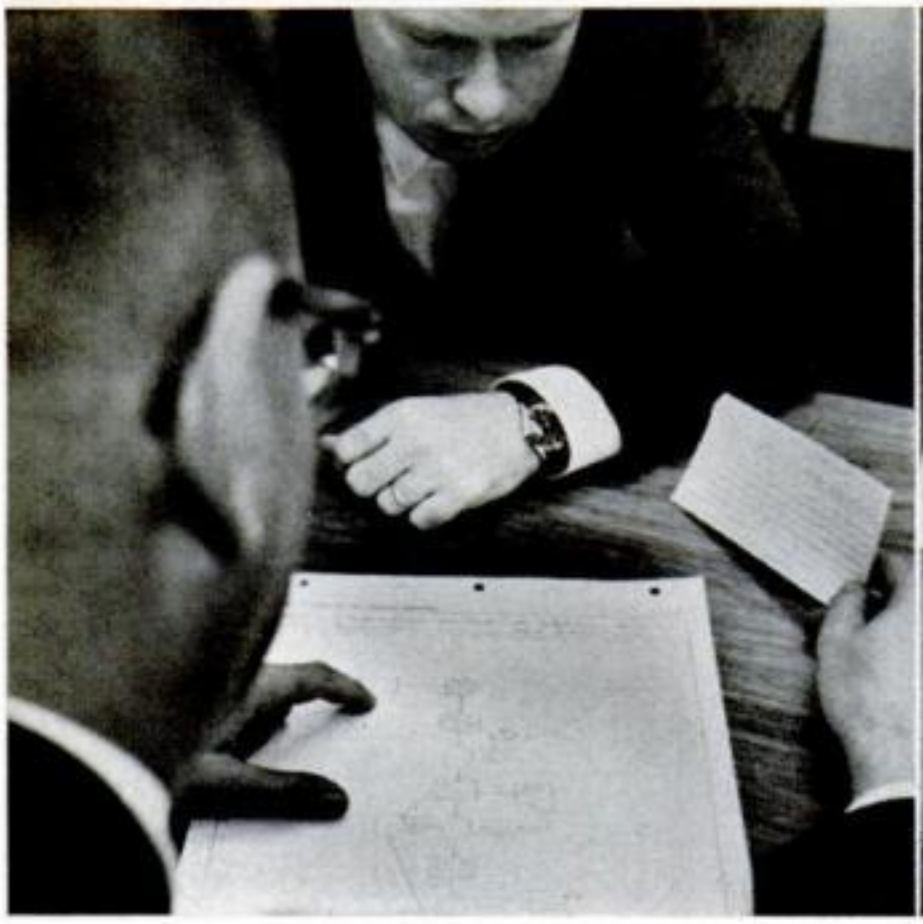
People who talk to computers are called programers. They instruct data-processing machines on how to perform specific jobs. Today there are about 40,000 of these specialists at work. In six years, experts say, 500,000 more will be needed. Many will require a bachelor's, master's, or even doctor's degree. But close to 50 percent will move into this new profession with only high-school diplomas.

Here's why there's such a tremendous demand for programers.

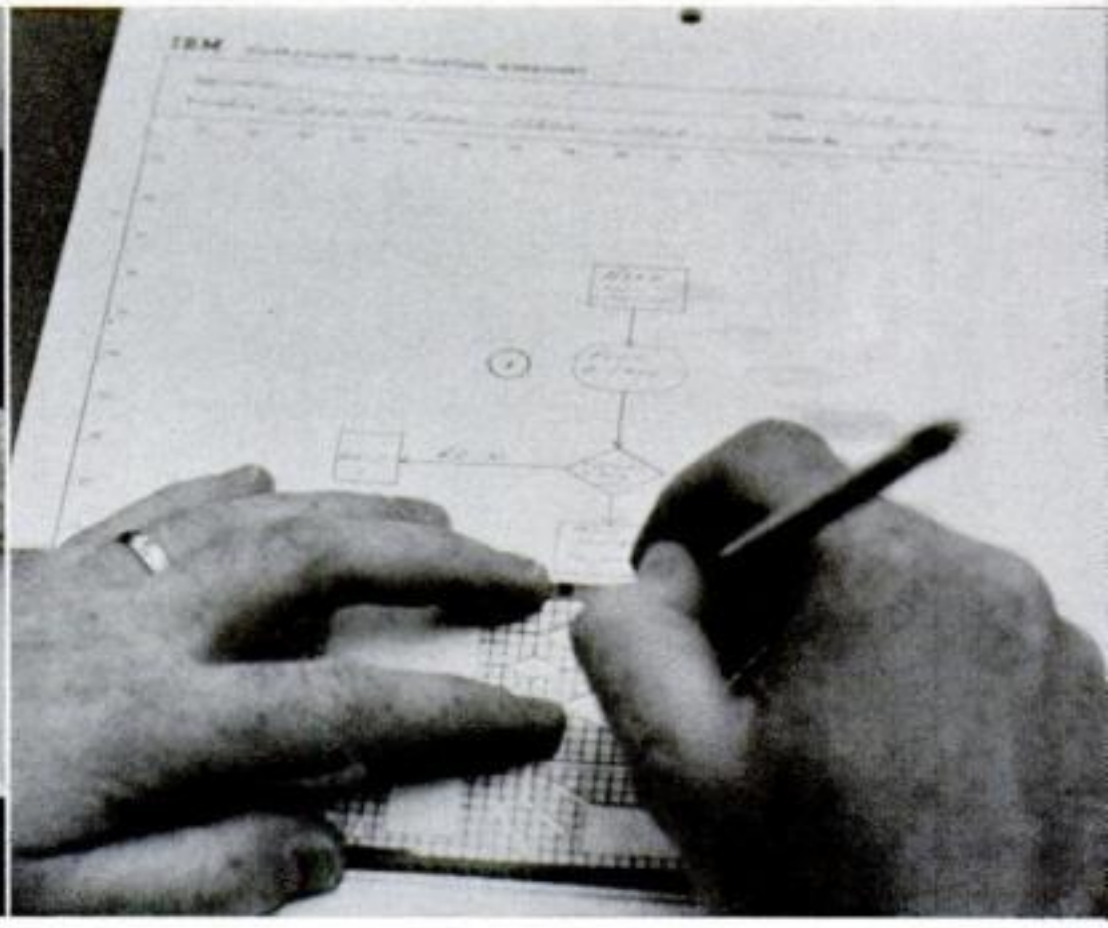
Computers are really very stupid multimillion-dollar collections of wires and transistors. Plug one in and it does nothing. Yell at it, curse, kick it—and still it remains mute. The reason: no instructions.

But once *people* write instructions,

The computer programer's daily work



1 From his boss, a systems analyst, the programer receives his assignment to work out a program for one section of a job planned on a flow chart.



2 First step: Draw a block diagram showing basic data-handling and logic operations computer must perform. Standard symbols are used in the diagram.

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You don't have to be a college man to get a good job in computer programing—today even high-school grads are stepping into excellent jobs with big futures

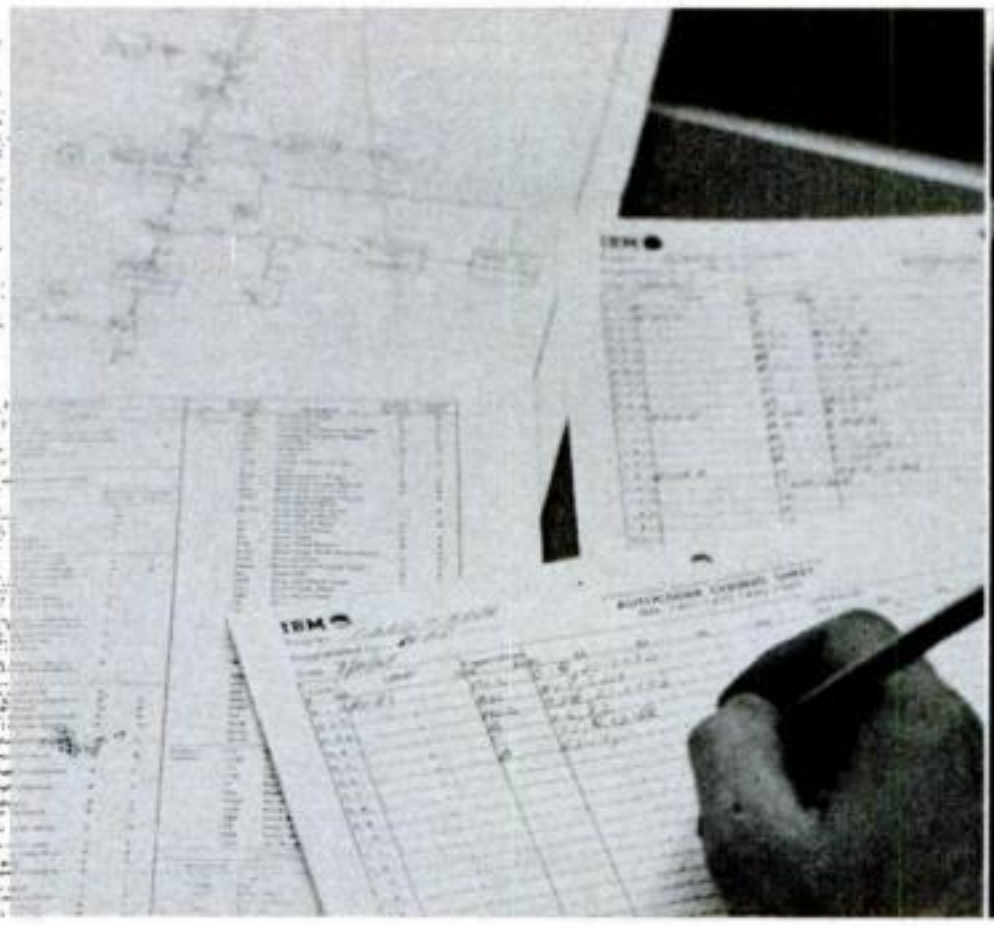
Feed Computers

the computer becomes a marvelous tool. It can tell the exact moment at which an astronaut should fire his retrorockets, or identify an obscure disease and prescribe a course of treatment. It can keep watch over huge inventories and write reorders when the stock gets low. Computers can prepare your paycheck, update accounts-receivable files—even print out past-due notices when you're late in paying bills.

Thousands of new computers are installed each year to do these jobs. Each one must be programed before it can start processing. This means anywhere from 1 to 100 people sitting down to figure out every possible step in a particular operation. These steps are translated into machine language, punched into cards, and fed into the computer. There they are stored for use during the solution of a problem.

Do you have what it takes to be a programer?

Education is important, but most important is a quick mind, with the ability



3 Consulting a special dictionary, programer spells out instructions in a "programing language"—a code describing standard sequences of machine operations.

4 Coded instructions, now punched into cards, are fed into a computer, which automatically translates steps into precise instructions it can follow.

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to see details. You must be able to stay with a problem until it's solved.

Where do you look for a programing job?

In many cases it will look for you, especially if you work for a company with a computer setup. Experience has shown that good programers are usually found within a company, and most firms will give their employees first crack at the job.

Supposing the job doesn't come looking for you?

You're still in good shape. Demand for programers far exceeds the supply. As an IBM executive told me: "At the current rate of new installations, it is virtually impossible for a qualified programer—no matter how he learns the profession—to be out of work."

How can you learn programing?

If you are a high-school or lower-class college student, your best bet is to complete as many mathematics courses as possible. Some secondary schools offer programing classes and data-machine operation. More than 100 colleges and universities offer full-fledged programing courses. Many lead to a degree in mathematics or physical science. And while a piece of parchment isn't essential, it does increase your value in the job market.

If you are out of school there are several courses of action:

- Night or technical school.
- Adult-education programs.
- Home-study courses.

Technical schools advertise in most big-city newspapers. Caution: Some are more concerned with collecting tuition than providing instruction.

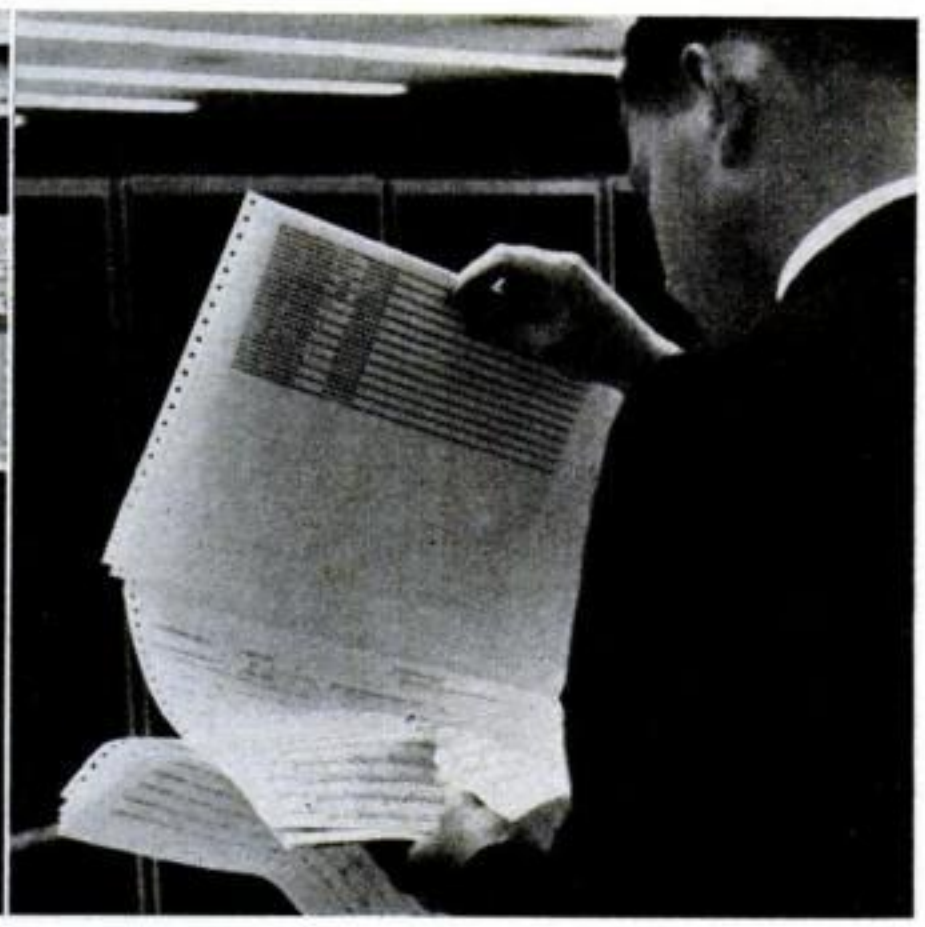
Contact the local office of a national data-processing firm and find out which schools they recommend. Among the major computer manufacturers are IBM, Remington Rand Univac, RCA, National Cash Register, Burroughs, Control Data, and Honeywell. Some offer their own courses. They will also supply you with literature about programing.

Home-study courses are really helpful. A recent experiment by a large industrial firm showed that programers who had successfully completed a home-study course did as well—if not better—than those who attended classes. Possibly the most successful of these courses was designed jointly by Pennsylvania State University and IBM.

What's the job like?

The first step in programing is to re-

5 Program is tested to see if it processes the data correctly. Programer can check its progress by reading numbers on the computer's control console.



6 Programer finally studies results printed out by the computer. The job of a programer was demonstrated in these photos by IBM systems engineer R. Reuel Stanley.

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Could you answer these test questions?

Sample these questions given to applicants for computer-programer training by Honeywell Inc. for a hint as to whether you have the aptitude to be an electronic-brain feeder.

1 An electronic-parts distributor has some transformers in one of his stockrooms. They all look alike but he knows that a mistake has been made and that there are two types of transformers (types A & B) in the room, and that there are four of each type for a total of eight. He receives a rush order from a customer for either two type-A transformers, *or* two type-B transformers. The customer has the equipment to tell the difference between the transformers, but the parts distributor does not. Since the transformers are very expensive to ship, the distributor ships the minimum number necessary. How many does he ship?

2 If the statement, "There are more dogs in the U.S. than there are hairs on any one dog in the U.S.," is true, then is the statement, "There are at least two dogs in the U.S. with exactly the same number of hairs," true or false? And why?

3 If a brick balances evenly with three-quarters of a pound weight plus three-quarters of a brick, what is the weight of the whole brick?

4 A light flashes once every five minutes; another light flashes once every 14 minutes. If they both flash together at 1:00 p.m., what time will they next flash together?

5 Alice is as old as Betty and Christine together. Last year Betty was twice as old as Christine. Two years hence Alice will be twice as old as Christine. Their ages?

6 A man and his wife live on the fifth floor of an apartment building and have no phone. Frequently, when he comes home from work at night, his wife asks him to run an errand before dinner, but of course not the same errand every night. So, in order to save himself a trip up the stairs every evening, she puts a light in each of the four windows that can be viewed from the street. What is the most number of errand messages his wife can choose from, at any one time?

Answers: *(1) 3. (2) True. The number of dogs exceeds the possible variations in the number of hairs they have. (3) 3 pounds. (4) 2:10 p.m. (5) 8, 5, and 3. (6) 15, assuming that four dark windows are not a signal for an errand.*

duce the problem to its simplest terms.

Let's take the task of multiplying two numbers together, adding a third to the product, and displaying the sum. In other words: the equation $d=ab+c$, which might be part of a bank program for calculating compound interest.

To get the machine to perform this routine, the programer will first have to write instructions in machine language that will cause *a*, *b*, and *c* to be read-in from an input device. Usually this device will be either a magnetic-tape unit or a punched-card reader. Thus, the programer will tell the computer which input device to go to, how to identify the input numbers, how to bring them into the main processing unit, and where to store them once they are in.

Next, number *a* must be transferred from the memory unit to a section called the multiplier register. Then *b* must be moved in and multiplied by *a*. After that *c* must be moved in and added to the product to form *d*. Finally, *d* must be moved to an output device—such as a high-speed line printer—where it is written out in a previously specified format.

Each of these steps will have to be analyzed, written out in flow-chart form, corrected, polished into block-diagram form and finally translated into computer codes.

What can you earn as a programer?

The average for a beginning or lowest-level programer is about $110 a week—although some firms pay as high as $170. A senior programer commands an average $150; a lead programer about $160; and a supervisor about $190.

There is also excellent advancement. It is not unusual to hear of a manager of data processing being made a vice-president of his company. And while managing a large-scale computer installation involves considerably more than just instruction writing, each of these men either started or served a term as a programer. ■■

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INSTRUMENT LANDINGS

Bad-weather landings are safer at Dulles. Incoming aircraft's navigation receiver picks up glide-slope and localizer signal 7 to 10 miles out. Narrow beams sent by ground transmitters cause pointers on gauge (right) to center when plane is on course. Pilot steers to keep them centered. Dulles has Instrument Landing System transmitters on two runways, plus Precision Approach Radar, which gives pilot radio directions from ground controller. Many large airports have only one ILS. Few have PAR.

THE TOWER

From here, controllers direct planes toward the runways by radio. They give approval to land or take off. The bubble on top of the tower "paints" a radar picture of the runways so the controllers can see the ground even in dense fog.

Dulles airport, 27 miles out of Washington, D. C., has more of everything—and all brand-new. It was built to handle the volume of traffic expected in the '70s, including supersonic airliners—and is better equipped to handle them than any other air terminal now in existence. Experts agree it's the airport of tomorrow—here today.

It has "more of everything";
that's why pilots say it's the

WORLD'S SAFEST AIRPORT

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CRASH CREWS

Hopefully, these rarely will be needed. Trucks are positioned so they can reach the runways in seconds. Pumpers, custom-built to fight plane fires, are the world's largest.

VASI LIGHTS

Visual Approach Slope Indicator lights, aviation's newest landing aids, are installed on 10,000-foot runway. Pilot sees red, red-and-white, or white, according to his altitude. Correct blend of red-and-white means plane is approaching at proper angle. The lights are always visible.

RUNWAY LIGHTS

Center-line runway lights let pilots land on the "dotted line." The lights, bedded in concrete, also trace taxiing route.

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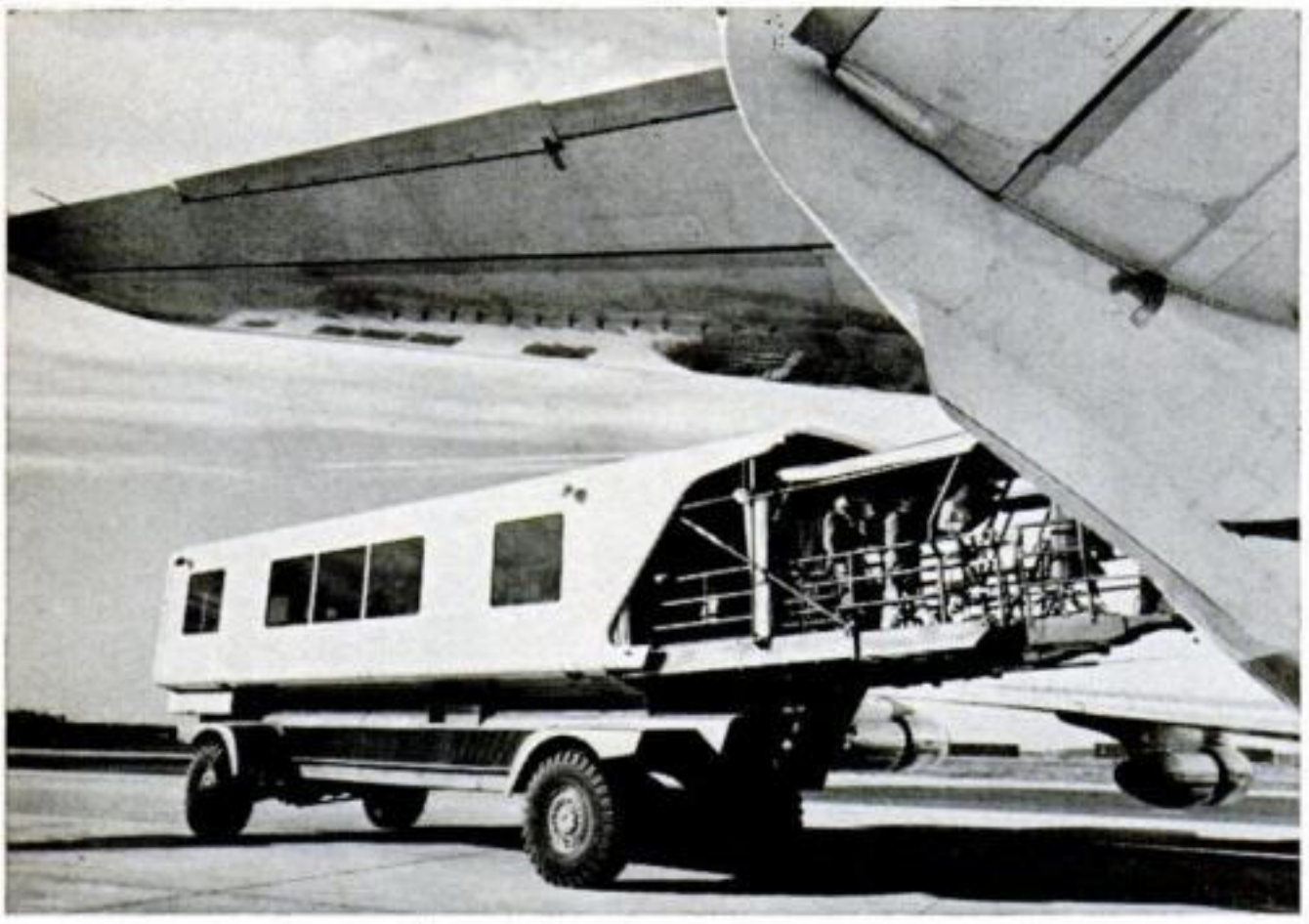
Dulles—the "airport of the future"—is the safest in



"Flying-carpet" feeling hits you when you take off from ultra-modern Dulles, the only airport in the world that has these air-conditioned, 13-ton lounges-on-wheels. Long hikes from the terminal to the plane are a thing of the past there. The lounges take you to the airliner's door. A telescoping ramp reaches almost into your seat. The lounges shut out airport noise, noxious exhaust fumes, and flying debris that plague passengers at other airports.

By Phil Geraci

THE sky outside the big Boeing jet was growing darker. Mel Harris, a Federal Aviation Agency official, peered through the double-pane window at the sunset. In Los Angeles the weather had been sunny. Four hours later, at 30,000 feet, he watched the sun drop into a solid floor of clouds.

Flight 702 was New York bound. In another half-hour, Harris estimated, he should be on the ground.

In the cockpit, Capt. Willie Myers frowned. Kennedy International Airport had just closed. A massive low-pressure area churning up from the Gulf of Mexico had chopped visibility all along the coast. First Atlanta, then Miami, Washington, Philadelphia, and New York airports had shut down. Only Boston remained open. Could he make it?

Myers took stock. Plenty of fuel—he could remain aloft for hours. But aloft doing what? Flying giant circles in the sky, waiting for the weather to clear? No percentage in that: too costly. Cheaper to head for Chicago, bed down the passengers, then carry them eastward when the weather cleared.

Myers flipped on his radio, raised a supervisor in Denver. His orders: head for Boston. It was cheaper to transfer passengers from Boston to New York by rail.

Then Boston closed. But even worse—his electricity went sour. Two generators were out. The others were still functioning, but not well. Myers reported the malfunction to his controller. Ordering the pilot to reduce speed, the controller now had to decide where to get him down.

Two years ago there was no really good answer. Today there is—Dulles International Airport, near Washington, D.C.—the world's safest, and the *only* complex of runways and electronic aids designed strictly for jets.

Getting a stricken jet down safely at Dulles is theoretically easier than at any other airport in the world. It has more landing aids, radar, and advantages in terms of unobstructed approach ways and visibility than anywhere else.

Air Traffic Control cleared the way for Flight 702 to approach Dulles.

In the control tower that dominates the airport—and from which, in clear weather, nearly every inch of Dulles' nearly 10,000 acres can be seen—were PAR (Precision Approach Radar) and

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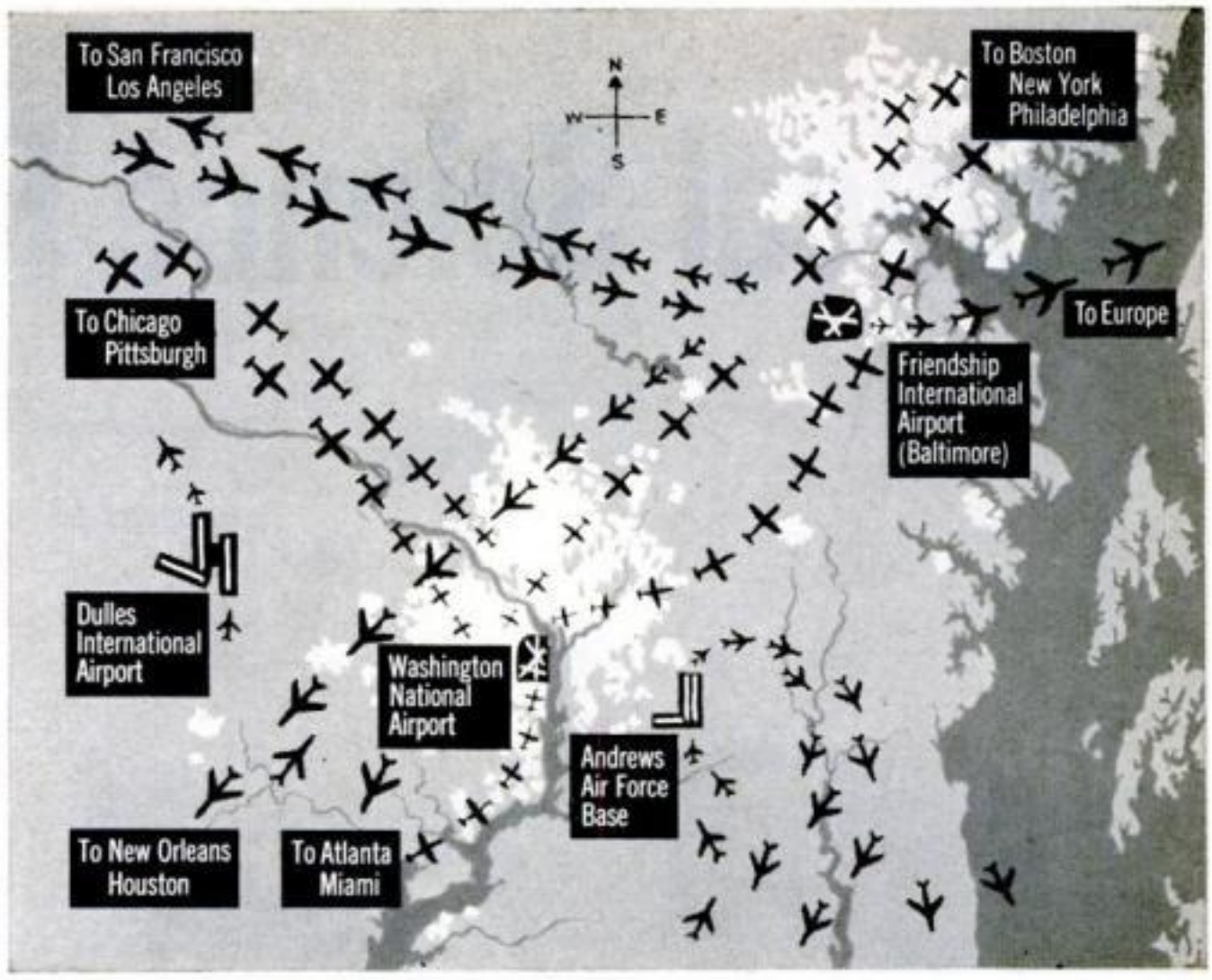

Safety was built into Dulles when the site on the plains that stretch eastward from Virginia's Blue Ridge mountains was selected. It is 27 miles from Washington, D.C., well west of the East Coast commuter air corridors that link Miami and Atlanta with Washington, Philadelphia, New York, and Boston. Inbound flights don't run into the holding areas assigned to nearby airports and have more empty air space to maneuver for perfect landing positions.

ASR (Airport Surveillance Radar) operators, monitoring the plane's descent on radar consoles and waiting to take over when control of the aircraft would be turned over to them. Dulles had been closed for nearly two hours.

The plane was vectored to the south, to make approach northward toward Runway 1R. This runway has both Precision Approach Radar *and* an Instrument Landing System. Captain Myers would use the ILS to establish his angle of descent and to line up with the runway. When within range of the ground transmitters (7 to 10 miles out) he could land without further ground assistance. But it was mighty comforting to hear that voice in his headphones and to know that any mistakes would be caught in time.

Myers stared at his navigation instruments, keeping his ILS cross-pointers centered. Suddenly, the instruments went dead. Tired generator brushes had just quit working. Flight 702 still was airborne, at low altitude, hurtling on at 140 knots toward an airport the pilot could not see.

Myers' left hand groped for a flashlight, while his right lugged back on the control column, to prevent a dive. Handing the flash to his copilot, Myers switched on his emergency radio (powered by its own D cells) and called the tower on an emergency frequency.

Seconds later, the PAR operator's voice returned to Myers' headset. "You are above the glide path and too far right. Turn left and increase your rate of descent."

Reading his air-speed indicator and altimeter by flashlight, Myers juggled the controls. A slight turn to the left, up a bit, a little to the right. The voice droned on in his ears: "I have you on course, your approach is good, you have passed the middle marker, you are now 1,000 feet from the runway." Then Myers saw the lights, 3,000 feet of brilliant white beams piercing the drizzle, headlining the approach of Runway 1R.

"Runway in sight," he said into the microphone. Ten seconds later, Flight 702 was safely on the ground.

In reality, "Flight 702" was just a practice exercise, with only a flight crew and FAA inspectors aboard. Rarely does an airliner lose *all* electrical power. But the danger of this is very real, faced every day by jet crews who rate weather as their number-one foe. These men thank their stars for Dulles. ■■

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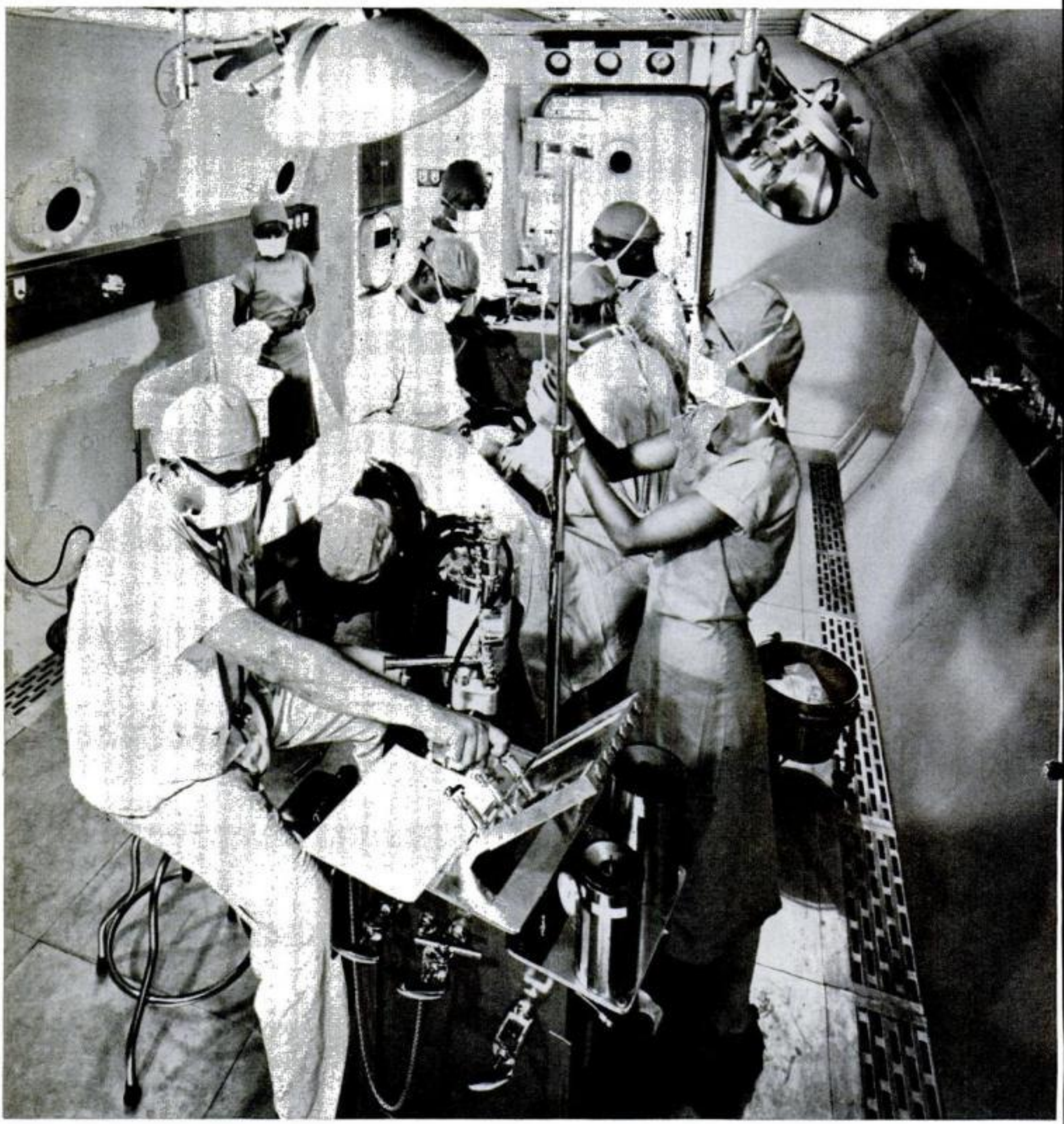
Medical Science Reaches



HIGH-PRESSURE OXYGEN CHAMBERS *are a new and promising medical tool. Researchers have found that oxygen when administered under three to four times normal atmospheric pressure penetrates into oxygen-starved body tissues. They've used it to save lives of people suffering shock from injuries, hemorrhages, or heart attacks. High-pressure oxygen therapy has also been used to cure gas gangrene and tetanus.*

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for the "Impossible"

What are the next big steps in medicine? Here's a look at what's coming from the research centers and what it can mean to you and your family

By Lawrence Galton

CAN medical research top its own startling record of development of the last few years?

Surgeons today perform complex operations they would not have dared 10 years ago. Hundreds of people walk around with built-in electronic heart pacemakers that keep them alive. Scores of thousands get along with nylon and dacron blood vessels.

What are the next big steps going to be? Here's a look at what's coming, based on work going on in leading research centers.

It seems almost certain we're entering the antiviral era.

No matter what you do now, the next cold you get will last seven days. That's because a virus causes it. Colds, flu, and hepatitis are part of a long list of other virus-produced troubles.

But the first drug to combat any virus disease is already in use. Called IDU, it cures a blinding eye infection that has affected 100,000 Americans yearly. A second drug, methisozone, hits smallpox viruses. Last spring, DuPont researchers reported a third, amantadine, as promising against Asian flu and German measles.

Another approach by scientists is based on the fact that if you get one virus infection, it's tough for another to attack you. Recently scientists found out why: As a virus enters a body cell, it causes the cell to produce a chemical, interferon. Interferon keeps out other viruses. Now work is going on to get interferon in pure form.

Other investigators, meanwhile, have made a discovery: It's a specific material in a virus—nucleic acid—that spurs interferon production; and any nucleic acid, not just one from a virus, can do the job. Scientists at one drug house, Pfizer, have given nucleic acid from ordinary commercial yeast to mice and induced enough interferon production to protect the mice against flu.

ANTIVIRUS vaccine work, too, is being stepped up. Today, we have protective vaccines against such virus diseases as polio and measles. Other vaccines being perfected are for chicken pox, German measles, croup, hepatitis, trachoma, and some of the respiratory ailments commonly called "colds."

Before long, some medical men believe, we'll be taking "supervaccines" capable of protecting us against a dozen or more illnesses at once. There's even a proposal to spray vaccines by airplane over large cities, immunizing millions through the air they breathe.

Even the day when vaccines protect against some forms of cancer may not be far off.

There's growing evidence that many, maybe most, cancers are virus-caused. Studies have linked viruses and tumors in animals. Recently, Baylor University doctors found virus-like particles in children with leukemia. Last summer, Dr.

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One challenge scientists see: pills to correct

James T. Grace of Roswell Park Memorial Institute, Buffalo, N.Y., reported growing what appear to be human leukemia viruses in the laboratory. The first anticancer vaccine may well be one to prevent leukemia.

NO ONE could call Dr. Michael DeBakey of Baylor University an idle dreamer. DeBakey, who heads the world's largest heart center, has pioneered many of the most brilliant feats of modern heart surgery. His prediction: an artificial heart within 10 years.

The human heart is essentially a pump. It has four valves that control flow. Recently, in Chicago, a patient had two bad heart valves replaced with artificial ones, a third valve delicately repaired. He is back at work today.

Already, experimental mechanical hearts have been developed. DeBakey has one made of dacron-reinforced silicone rubber, operated by a plastic bellows that pushes air through tubing to squeeze the chambers and make them pump blood. Inserted through the chest in only 20 minutes, the equipment has taken over the entire circulation in animals.

DeBakey's pump is triggered through an electronic relay by power from outside. Now the Baylor group, working on refinements, has found that a large shoulder muscle can be harnessed to drive the air bellows—and the muscle can be made to contract with an implantable electrical stimulator.

PROMISING work is going on, too, with many other artificial parts. At Chicago Wesley Memorial Hospital, Dr. Bruce Bodell and associates have made an artificial lung out of coils of silicone-rubber tubing covered with Teflon. Oxygen is fed in—and blood, flowing through the delicate coils, picks it up.

Before long, chances are, you'll meet an amputee and not realize it. Scientists are beginning to make it possible for people who have lost legs—in war or through accidents—to walk with artificial limbs that look and work like the real thing. The Veterans Administration, for example, has a revolutionary artificial leg with a hydraulic knee mechanism that makes walking easier.

Scientists at the Moscow Institute of Prosthetics have developed an artificial arm activated by muscle nerve impulses. Inside a lifelike shell coated to resemble human skin, there's a complicated mechanism consisting of electronic amplifier, storage cell, electric motor, and reducing gear.

At Case Institute of Technology, Cleveland, an extraordinary "arm aid" has been developed for the paralyzed. A self-powered steel framework holds the patient's arm. By flicking an eyebrow he can turn on an infrared light in the frame of his specially designed glasses, and direct the beam to some object he wants. A little programed computer activates the steel framework so it moves the arm toward the object and allows it to be grasped. Case researchers now

ALMOST REAL, *new hand on right arm of a Russian repairman shows amazing progress made with artificial limbs. Biohand was developed at Moscow Institute of Prosthetics.*

Urheberrechtlich geschütztes Material

plan 16 programed activities for the device, including brushing teeth, eating, shaving.

Meanwhile, in many laboratories, work on organ transplantation continues [see "Desperate Gamble: Organ Transplants," PS, Dec. '64]. With a new technique, Dr. Leonard Marmor of the University of California, Los Angeles, has successfully transplanted human nerves. He freezes a nerve first, then uses special radiation on it before transplanting it. He has achieved successful transplants from person to person—and has also transplanted human nerves to dogs. He expects that animals can return the favor.

A BIG new story in medicine is growing evidence that people can become allergic to parts of themselves.

As a defense against disease, the body produces blood antibodies that attack disease bugs. But the mechanism can go wrong. Recently, investigators have been finding antibodies that attack heart, kidney, thyroid, muscle, nerve, and blood cells—as if they were enemies.

Nobody knows why this happens.

Some very potent drugs—such as 6-mercaptopurine—can destroy antibody-making tissues. Drug makers now are looking for better, less poisonous types. But these knock out the body's whole antibody defense system. Ideally, doctors want a selective method of blocking only a single undesired antibody response.

MANY new discoveries from non-medical fields promise to open an exciting new chapter in medicine.

The laser is one. The device produces an extremely sharp and powerful beam of light energy. One of its first medical uses has been to weld together a torn eye retina and restore sight.

In many research centers, doctors are trying the laser—with promising results—to do delicate surgical cutting and also to close up wounds by fusing the skin. They've grafted human cancers into animals and made some of them disappear by laser treatment.

MESH HEART, *made of dacron, has four ball valves to control the flow of blood. Doctors at Cleveland Clinic Foundation hope to implant one in a patient within three years.*

SOME intriguing work is being done on body electrical forces by Dr. Robert O. Becker at the Syracuse (N.Y.) Veterans Administration Hospital. In animals—and man—the electrical field is negative at the forehead, positive at the back of the head. Becker has knocked animals unconscious by reversing this polarity. He has also found that when an anesthetic is administered, the reading at the forehead gradually moves from negative to zero. Some anesthetists now use electrical-charge readings to determine when patients are ready for the surgeon's knife.

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But the implications of Becker's research go further. When a salamander's leg is lopped off, the animal's electrical charge shifts from negative to positive. As it regenerates a new limb, the electrical field works back to normal negativity. By reinforcing the negative charge with electric current, Becker has been able to speed up regeneration. He is hardly ready to say the human body may be helped to regrow lost limbs or vital organs, but the principle may prove useful in speeding the mending of broken arms and legs.

DOZENS of tranquilizers and other mind medicines have been developed in the last 10 years.

Researchers are optimistic about discovering new drugs to cope with mental illness. Some, like Dr. Frank Berger, who developed Miltown, are even more ambitious. Berger sees, as a challenge, the development of pills to correct criminal minds.

Even the "normal" mind, he suggests, might use some help. In experiments during brain surgery, long-forgotten memories have been recalled when certain brain areas were stimulated. Says Berger: "A genius or creative person may simply be one better able to utilize information available in his brain and lift it out from the unconscious. There is a true need for a drug that would enable us to utilize to the full the wonderful potentials of our brains."

RECENTLY, Dr. Charles Huggins of the University of Chicago found that mice didn't get cancers after a dose of a known cancer-producing hydrocarbon found in cigarette smoke, if they first received a small amount of a similar hydrocarbon.

While animal research doesn't always apply to man, Huggins thinks that pills may well be developed that could shield smokers against cancer-producing substances in cigarettes.

The fact is that in just the past two decades 365 basic new drugs have been introduced into medicine. Today the pharmaceutical industry alone is spending close to $400 million a year on drug research. And research for new drugs is going on in universities and federal research facilities.

With all that effort, no scientist today would call anything impossible. ■■

SUB-ZERO COLD *produced by liquid nitrogen is now helping to repair detached eye retinas at New York Hospital. Lasers are being used by other research centers to weld torn retinas and restore sight.*

Photo by Bernard Cole, Clinical Trends

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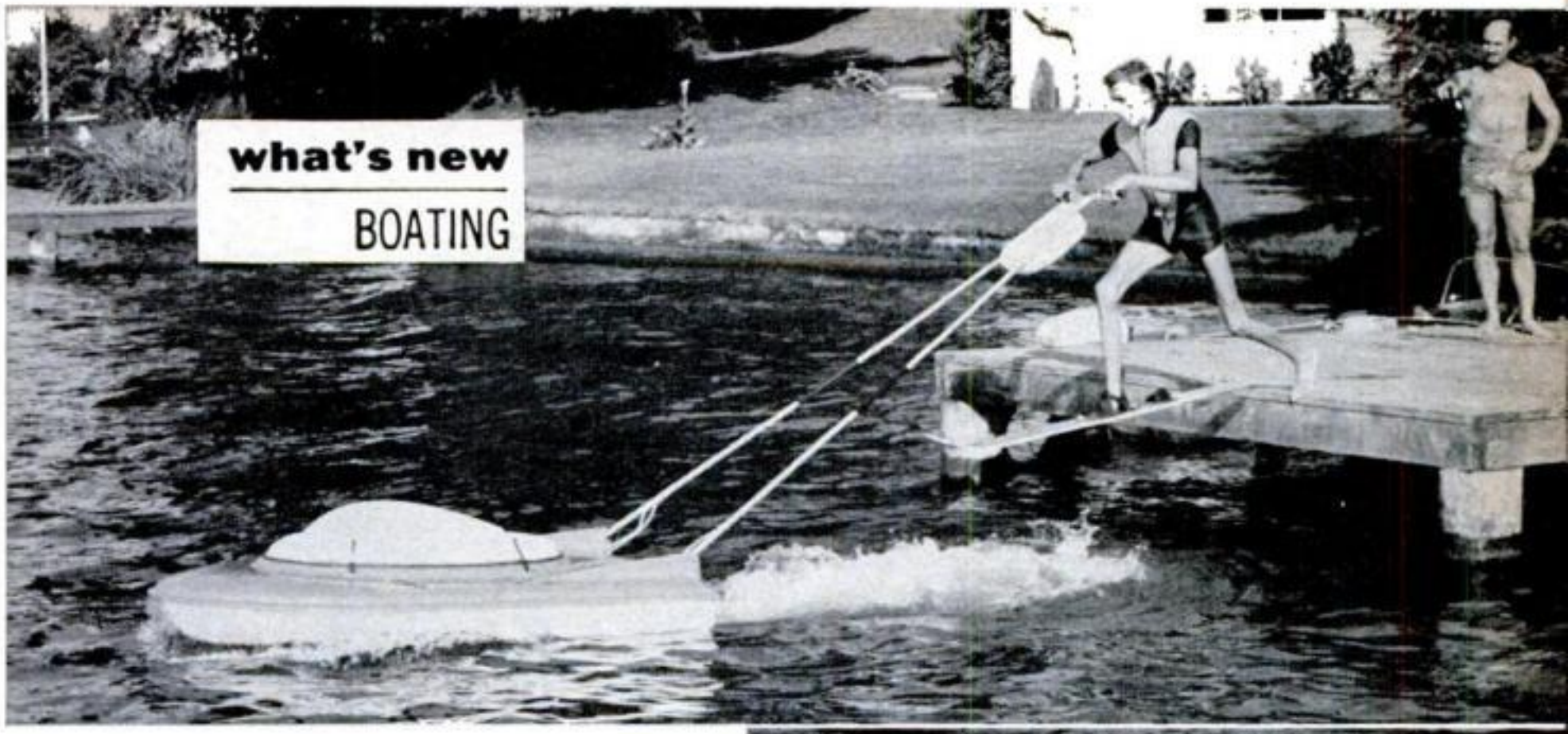
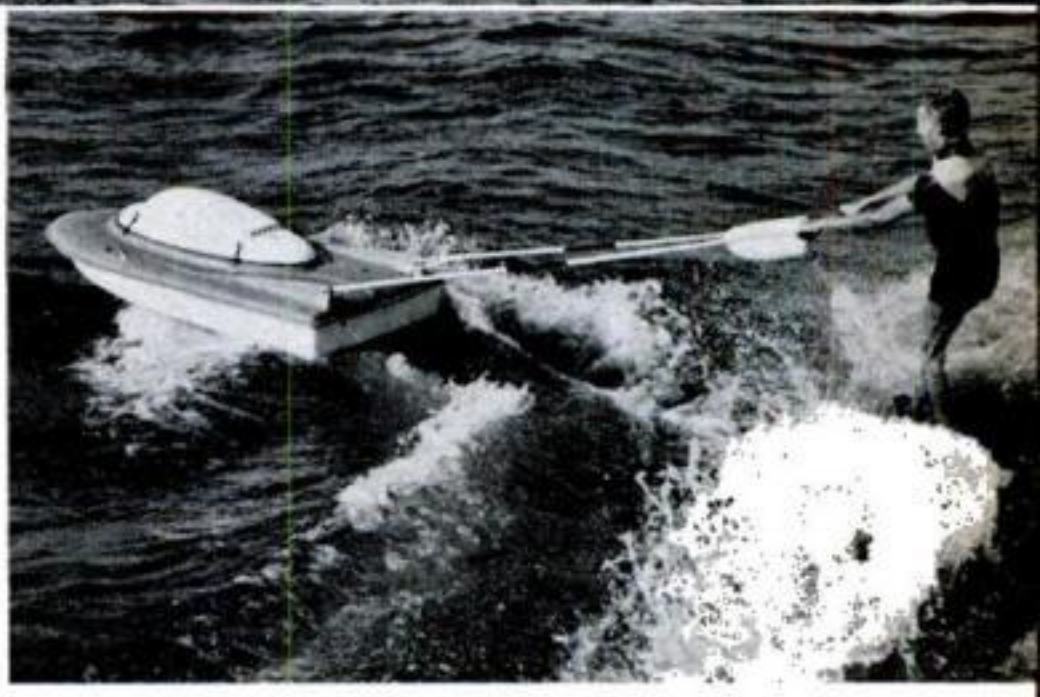


Drive-Yourself Water-Ski Machine

This new self-powered unit puts *you* in the driver's seat for your own water skiing. Ski Craft uses the new NSU Wankel engine [see p. 60]. It speeds up to 30 miles an hour, burns less than a gallon of gas an hour, weighs 130 pounds. Dead-man ignition switch stops the motor if you fall. Ski Craft, Inc., 1507 12th Ave., Seattle.



Boating bicycles built for two: one side by side, one tandem

This new catamaran bike (left) can carry 600 pounds, and is powered by your own two feet through a V-belt drive. The bearings are self-aligning, and the drive system is armorplated against rust. Canopy is optional. Aqua-Bike costs $385 from Kayot Co., Mankato, Minn. You don't need Gay Nineties costume for the Aqua-Cycle (right), but it's more fun. A four-foot-power tandem, it's just the thing for a Sunday afternoon when sidewalks and highways are crowded. Waterways, Inc., McCook, Ill.

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Hunting knives—fit for Jim Bowie and you

Helpful pointers on

Knives for

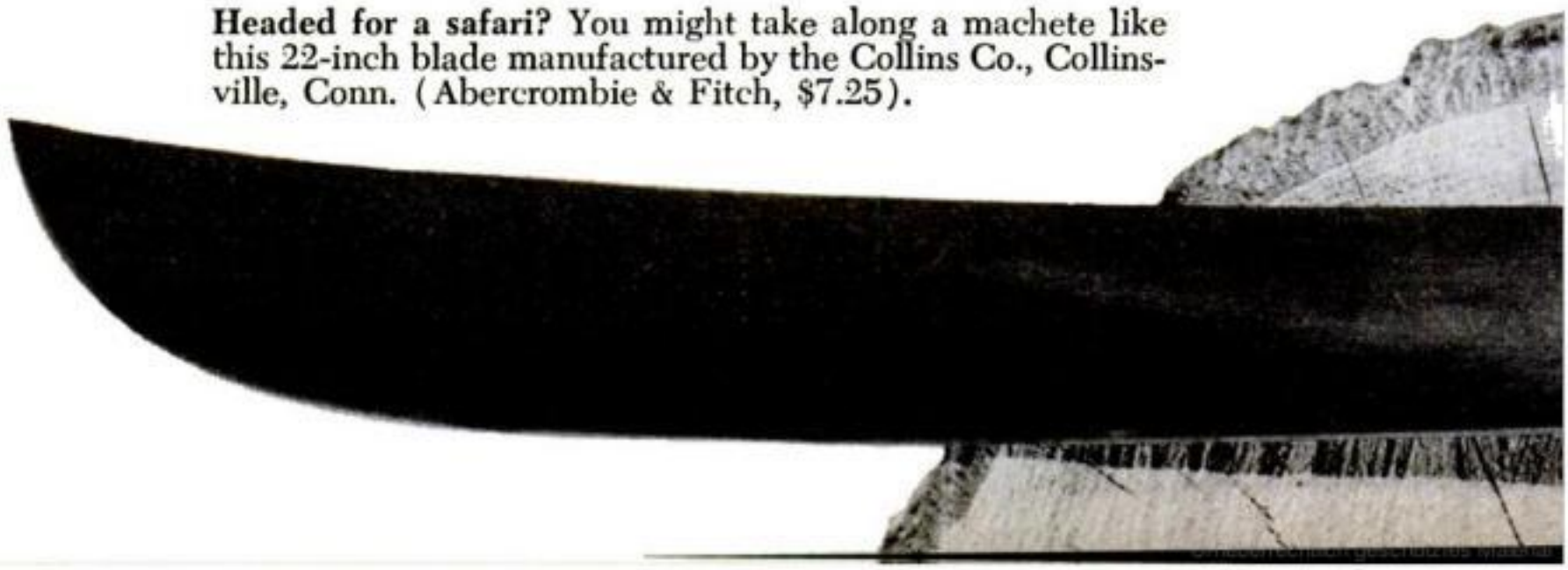
By Ken Warner

IT PAYS to be sharp about your sport knives—the hunting knife you rely on in the woods, a handy pocketknife, or fishing cutlery to clean a whopping catch.

The most important thing to remember about any of them is that the only blade worth having is one that will take and hold a keen edge.

Choosing one that will hold an edge after long use isn't easy. You have to select from literally thousands of makes, styles, and quality levels.

Headed for a safari? You might take along a machete like this 22-inch blade manufactured by the Collins Co., Collinsville, Conn. (Abercrombie & Fitch, $7.25).



PHOTOS BY ROBERT D. BORST

Outdoorsmen

There are expensive forged "limited-edition" brands whose makers count annual production in dozens. Others are mass-produced. But many experts claim that metallurgical research in recent years has enabled big manufacturers to make reasonably priced knives as good as or sometimes better than costly hand-made knives. Whichever you choose, the elements to scrutinize are: blade, handle, and sheath.

The blade. As the most important part of your knife, the blade should get the most consideration. Choose a blade according to the use you will make of the knife. A

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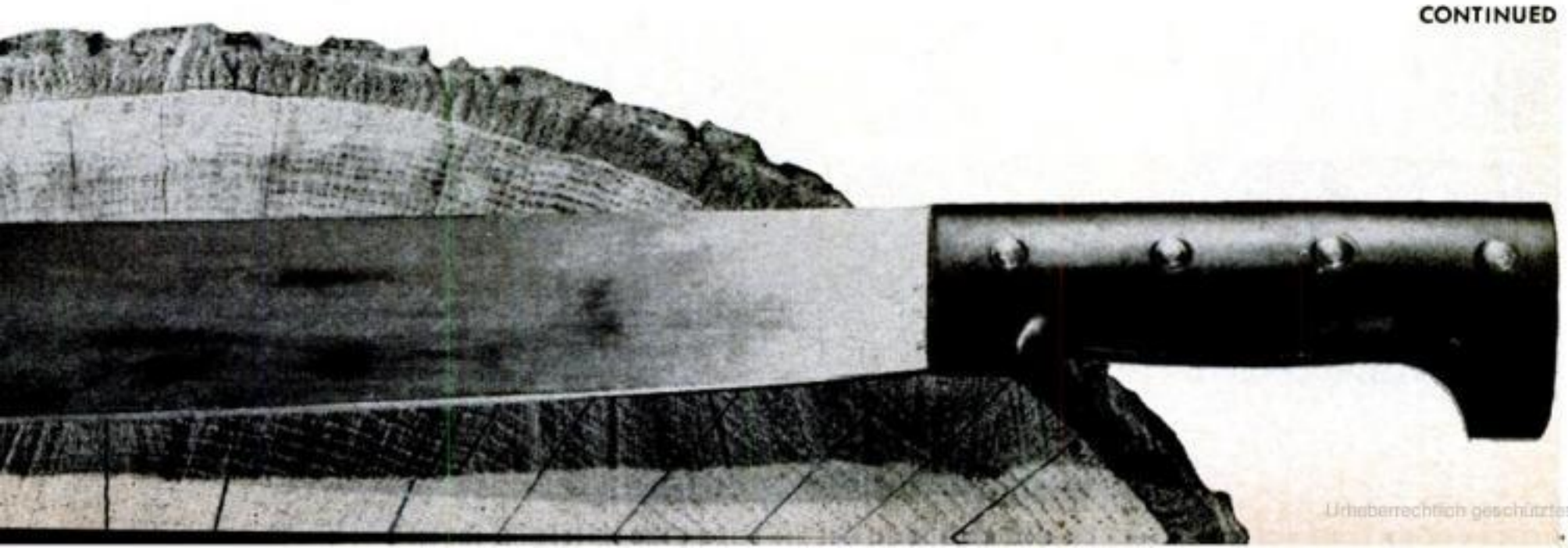

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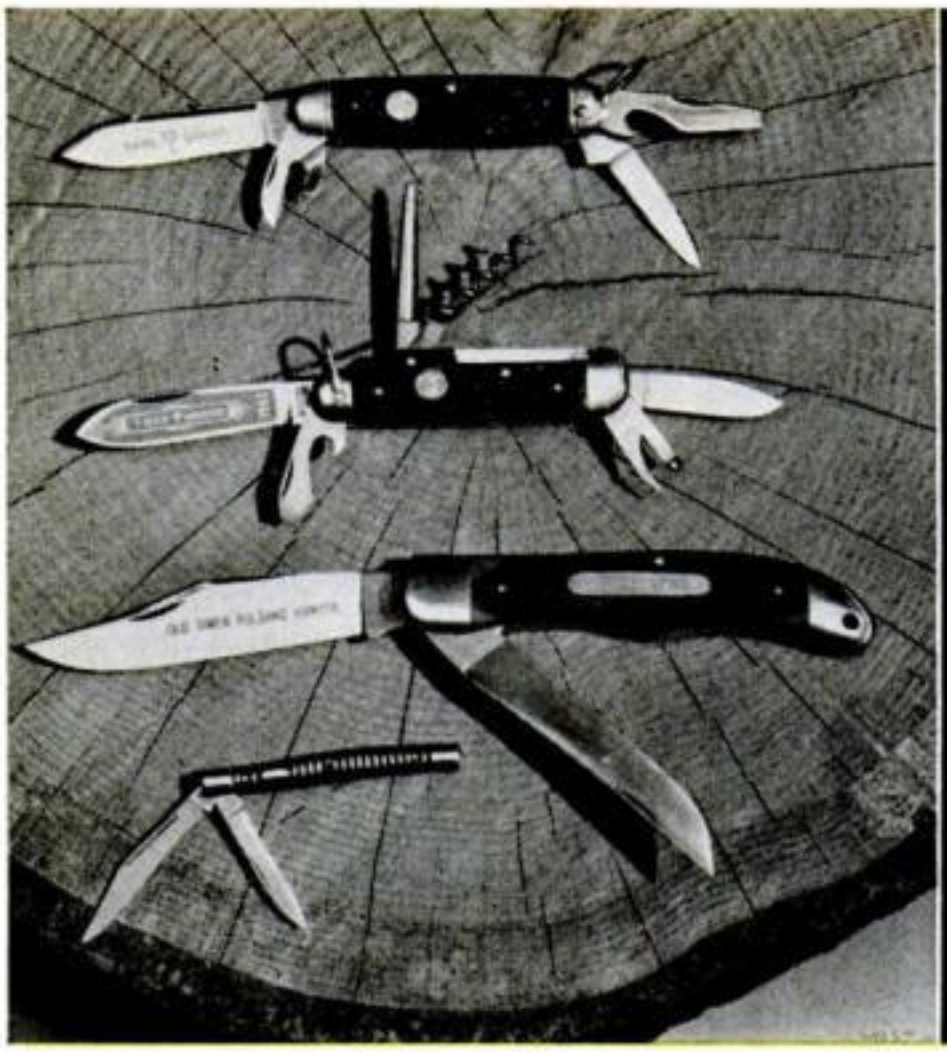
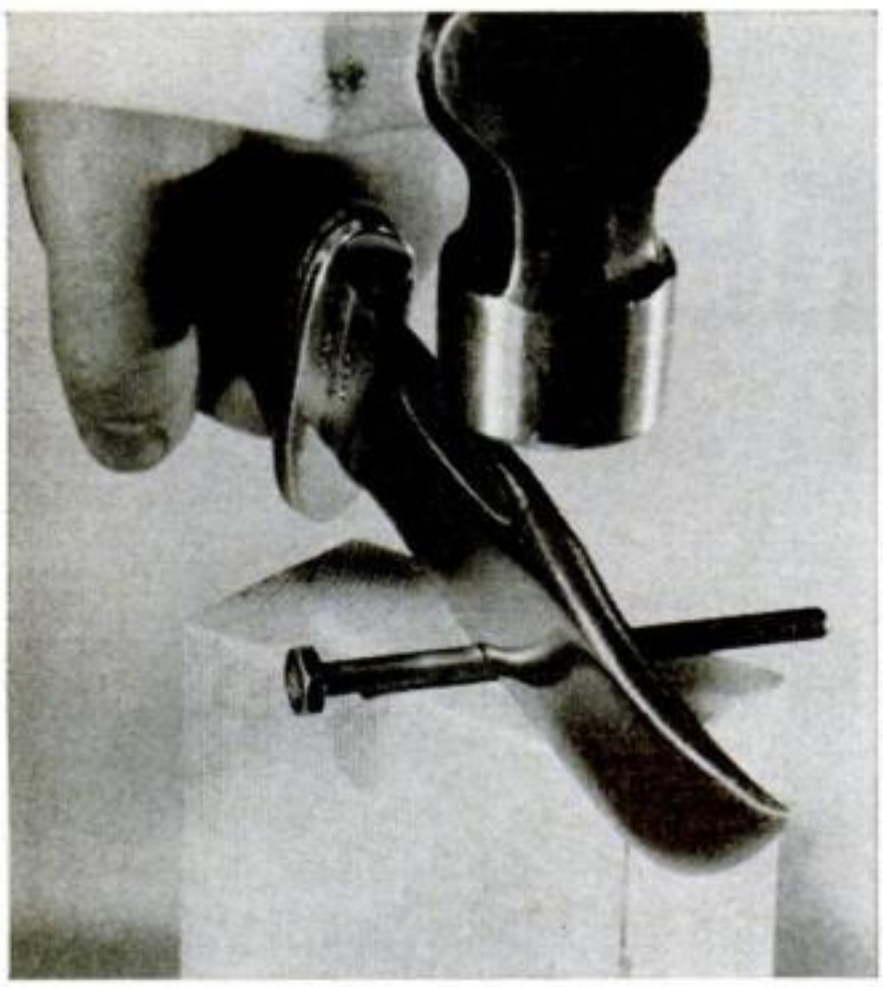


Typical pocketknives (top to bottom): Boker Tree Brand with can and bottle openers ($3.25), with corkscrew and awl ($5.25); Schrade Walden Old Timer folding hunter ($11.95); Imperial penknife ($1.89); and (above) Swiss Army Champion (Abercrombie & Fitch, $16.50).

straight, narrow blade is right for the short crosswise and long slicing cuts used when cleaning fish. A thin point is good for ripping fish open.

Going after big game? Then you'll want a skinning knife with a curved wide blade, pointed enough to do some sticking. The curved blade allows you to take long strokes without running out of edge. The width helps keep the knife on course. But if you hunt small game, a short, thin-bladed knife with a fine point is best.



Some hunting knives are so well tempered you can cut through a steel bolt without damaging the cutting edge. We used a Buck Special ($20) to show this. You can't cut through with one whack, but several blows with knife held at 90-degree angle will split the bolt.

If you don't hunt, but go in for rugged outdoor living, then cast your vote for a stout, straight blade that is slender in profile.

For a quick and big cutting job, whether to build a shelter quickly or butcher a 600-pound elk, a good big knife beats a good little knife. Carry a pocketknife for any fine cutting.

Most knives are a compromise in thickness. A thin-edge blade is keener but less sturdy, and loses its sharpness sooner. A good knife blade tapers from tang to point as well as from back to edge.

Unless you're an expert, casual scrutiny won't tell you whether a blade is good or not. Here are the features to look for:

1. The maker's name and address should be plainly marked. That's so you can send it back if it doesn't hold up, as good knives are guaranteed to do with normal use.

2. The finish should be mirror-bright. Dull finishes hide flaws and imperfections that glossiness brings out. Chrome-plating is no longer the sign of a cheap knife; it's

[Continued on page 208]

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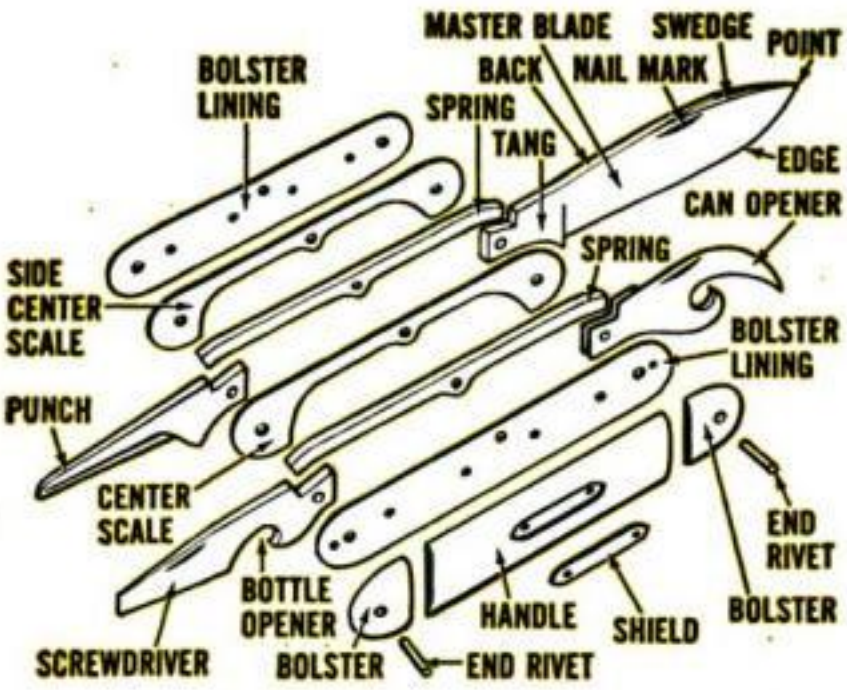
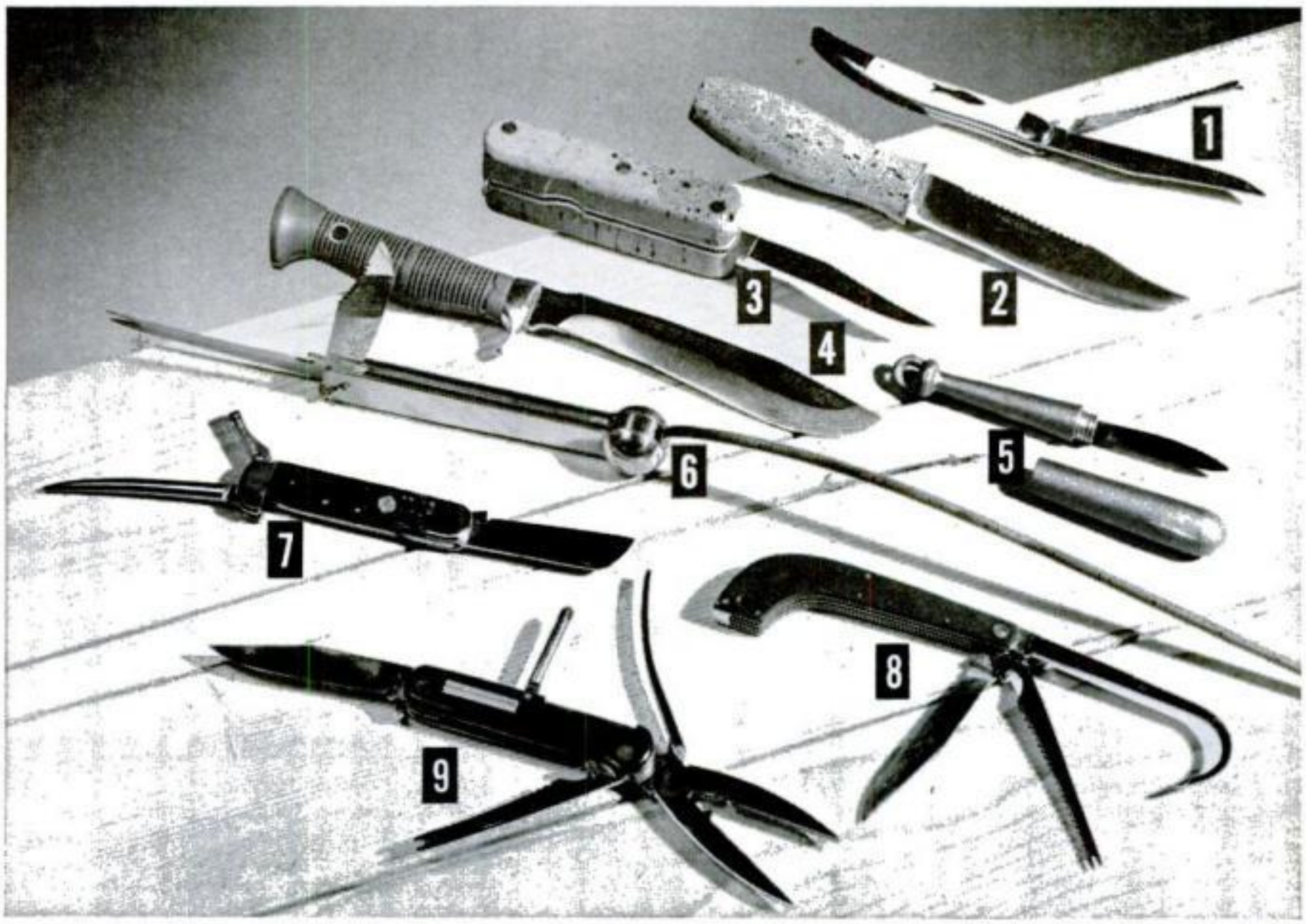
ANATOMY OF A POCKETKNIFE



The complicated construction of a pocketknife is shown in the drawing above. Careful tooling and fitting of parts is necessary to make the blades open smoothly and fold back into the handle. The blades must rest at just the right height so you can pry them open easily by lifting from the nail mark.

Versatility is built into this fancy Case hunting kit. The handle fits both the knife blade and the axe, and even has a conveniently concealed tape measure (Abercrombie & Fitch, $19.95).



Boating and fishing blades incorporate some of the most ingenious knife designs. Above: 1. Imperial Sports Master ($1) with standard single blade and scaler/hook disgorger. 2. Abercrombie & Fitch floating cork handle ($4.95). 3. Hoffritz floating folding cork-handle knife ($5.50). 4. Abercrombie & Fitch Puma Sea Hunter ($14.95). 5. Hoffritz Fish KO ($3.75). 6. Abercrombie & Fitch Angler's Mate ($9.95), with rule. 7. Boker Tree Brand boating knife ($6). 8. Hoffritz gaff-hook knife ($6.95). 9. Hoffritz fishing knife with scissors ($11.75).

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What You Should Know

Unless the fire starts in the cylinder at exactly the right time, you

By Frank L. Greenwald

WHAT are the odds that you're wasting gas and losing power in *your* car? In a recent spot check in California, out of 92 cars selected at random, only 30 had spark timing set at manufacturers' specifications. In another survey, 65 percent of the cars checked were out of time—31 percent overadvanced, 34 percent retarded beyond their specs. Yet adjustment is simple. A mechanic can do it for you in five minutes, or you can keep a regular check on your own engine if you'll acquire some simple equipment and know-how.

Why all the sweat? Must spark timing be so complicated? Why not just wait until the piston reaches the upper limit of its compression stroke and have a simple switch, with one pole for each spark plug, trigger the spark?

After all, valves don't require timing adjustment after the engine is assembled, so why should the ignition? The answer lies in flame propagation and cylinder pressures.

First of all, the fuel and air mixture is never exploded—it is ignited and *burned*, even though the whole process might appear to be instantaneous. Actually, at the instant the spark occurs, a small quantity of fuel is ignited adjacent to the spark-plug electrodes. This flame expands and keeps igniting additional fuel, as ripples spread in a pond from a stone thrown into the water. However, as this flame wave spreads (propagates) through the combustion chamber, the remaining unburned mixture is crowded into a smaller and smaller space. If this last portion of the fuel is compressed too much, it will ignite spontaneously from the heat generated by the pressure. Harmful detonation, the familiar "knock" or "ping," is the result.

At idling speed, the burning process cannot be started too soon or pressure will be exerted against the piston before it reaches top dead center, in effect hindering instead of helping crankshaft rotation.

On the other hand, at high engine speeds, if the burning process is not started soon enough, the fuel-air charge may still be

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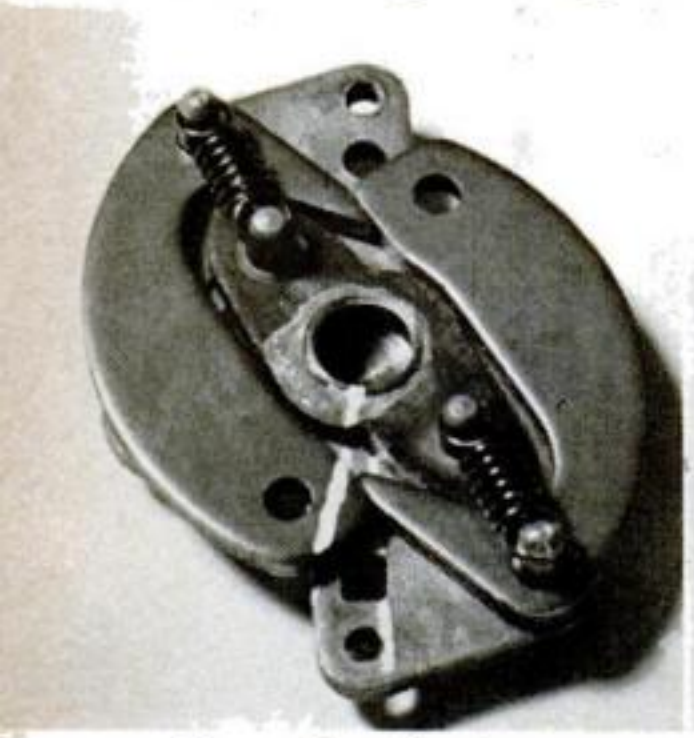
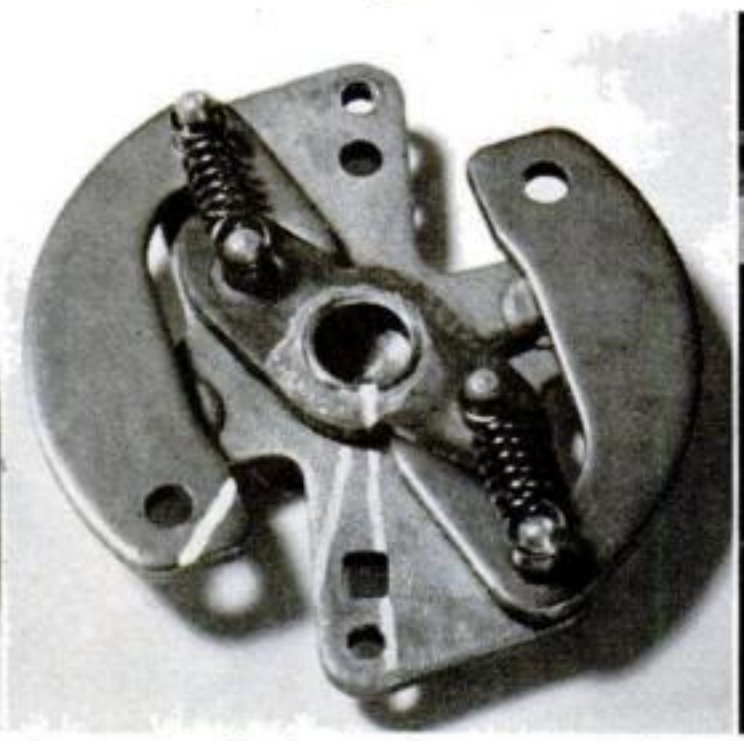
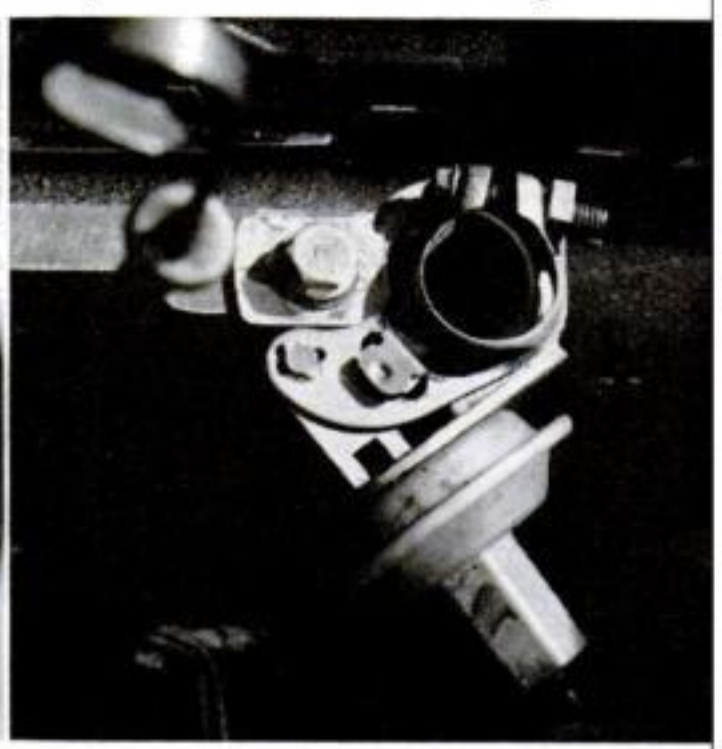
Centrifugal weights and vacuum cylinder control spark automatically



Centrifugal-advance mechanism of distributor has hook-shaped flyweights pivoted at "elbow" on weight plate. Short springs hold weight plate relative to cam turned by the shaft.



As shaft speeds up, centrifugal force swings weights out so inner ends push on cam, moving their pivots and the base plate to left, in direction of rotation, which also advances points.



Vacuum-advance cylinder is supported by a bracket bolted to cylinder block with clamp ring that grips distributor's housing. Distributor is turned in response to vacuum pressure.

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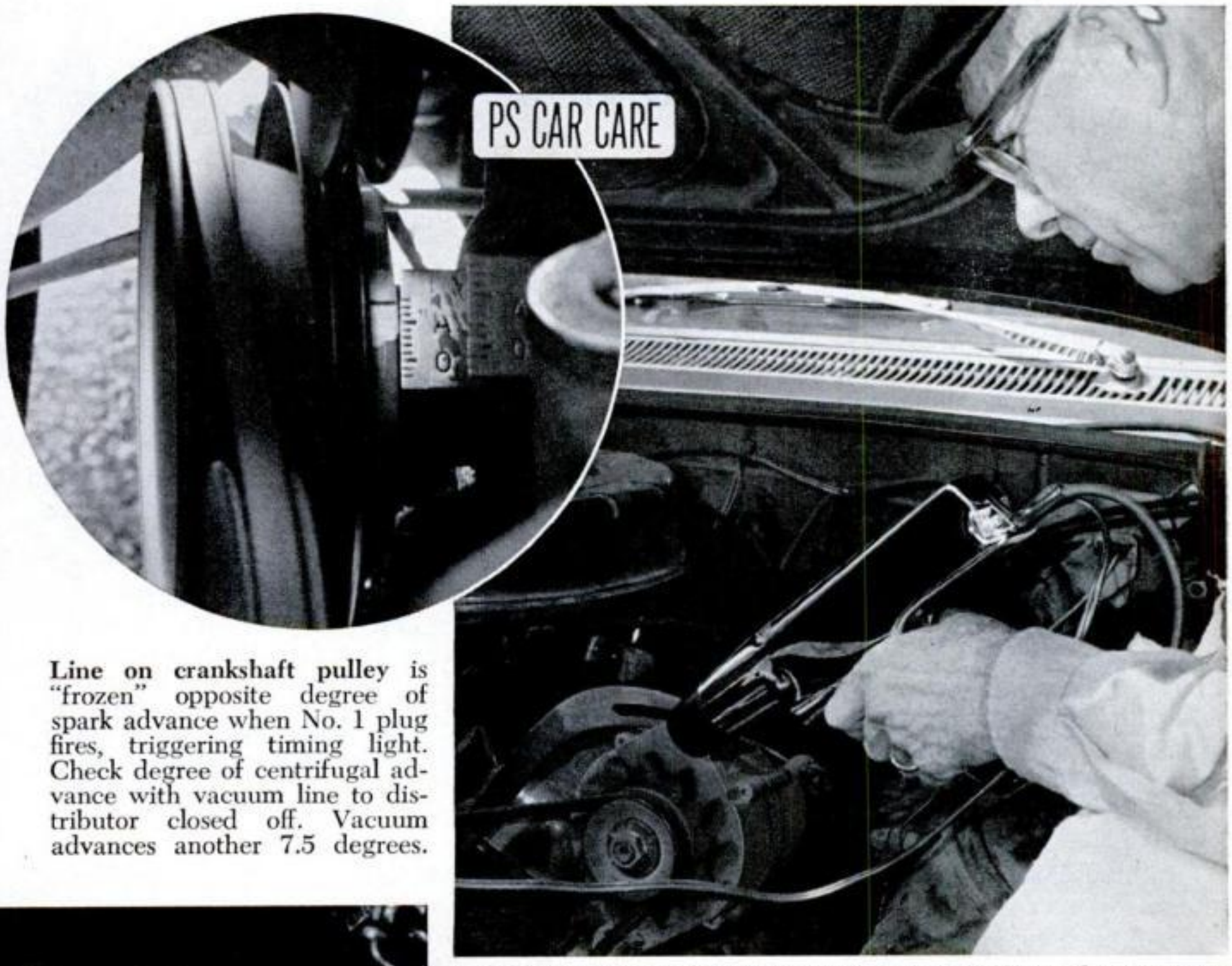
About ENGINE TIMING

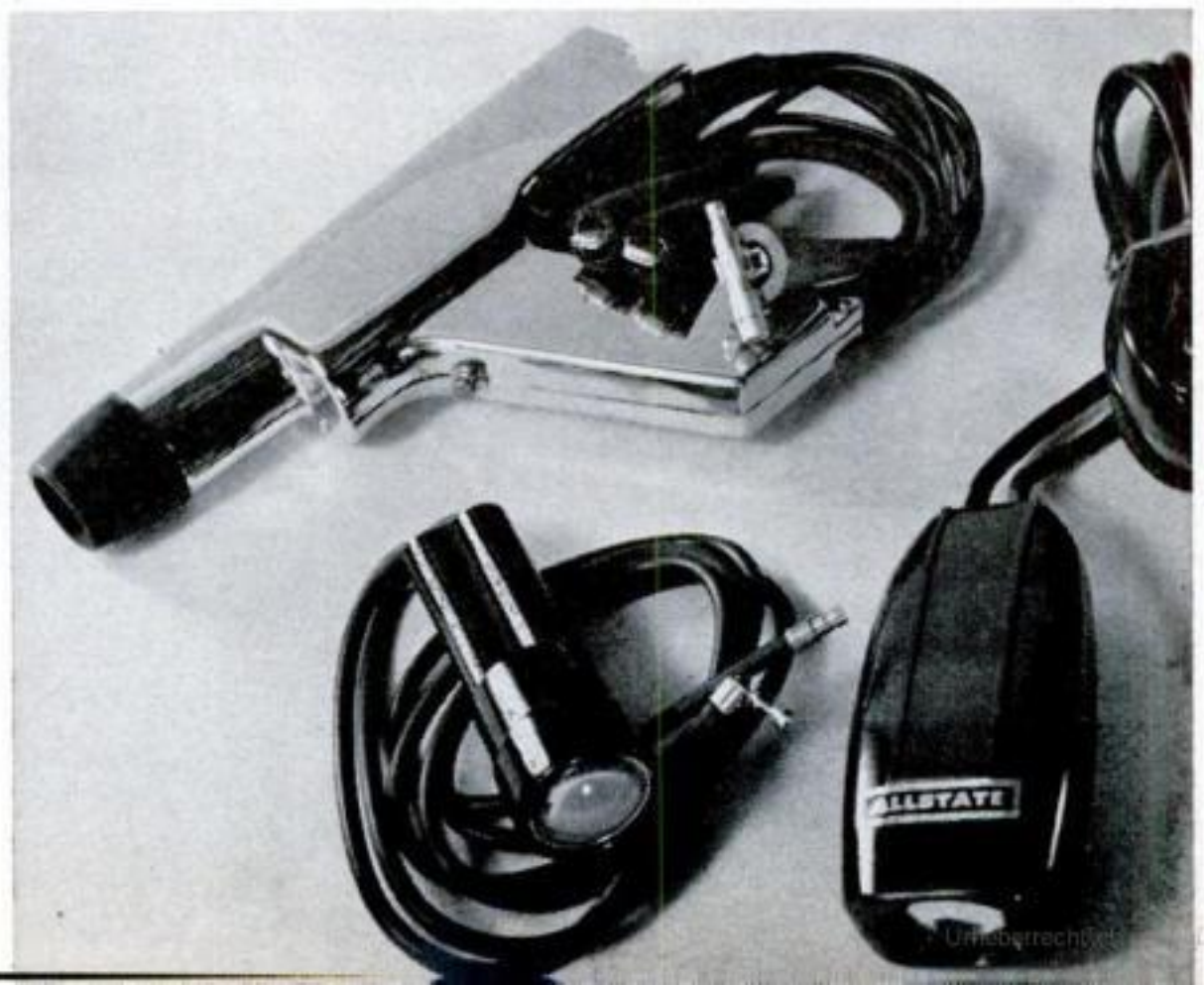
waste gas, lose power, and may even do serious damage to your engine



Line on crankshaft pulley is "frozen" opposite degree of spark advance when No. 1 plug fires, triggering timing light. Check degree of centrifugal advance with vacuum line to distributor closed off. Vacuum advances another 7.5 degrees.

A timing light is a must for accurate engine timing. They come in three types (below): brilliant "power" type fed from car battery, AC-operated "power" type, and dimmer neon-glow lamp.

Another type of vacuum advance mounts the vacuum cylinder on distributor housing. Linkage connects diaphragm with breaker-point mounting plate, which it rotates for advance.



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burning while on its way out of the cylinder through the opening exhaust valve. Such a retarded or "late" spark will cause engine heating, not because it produces "hotter" combustion but because the heat that is developed cannot be converted into useful work against the piston.

Some simple arithmetic shows why correct ignition timing is so important. At 600 r.p.m., the crankshaft is turning at the rate of 10 revolutions or 3,600 degrees per second. Since the entire power stroke in a cylinder takes place during 180 degrees of crankshaft rotation, there is a theoretical maximum of 5/100 of a second to burn the fuel-air mixture. In contrast, at 6,000 revs, there is only 1/10 the time, or 5/1,000 of a second from the time the piston reaches top center on its compression stroke until it reaches bottom center at the end of the power stroke. And we have to burn all of the fuel long before the piston reaches the bottom!

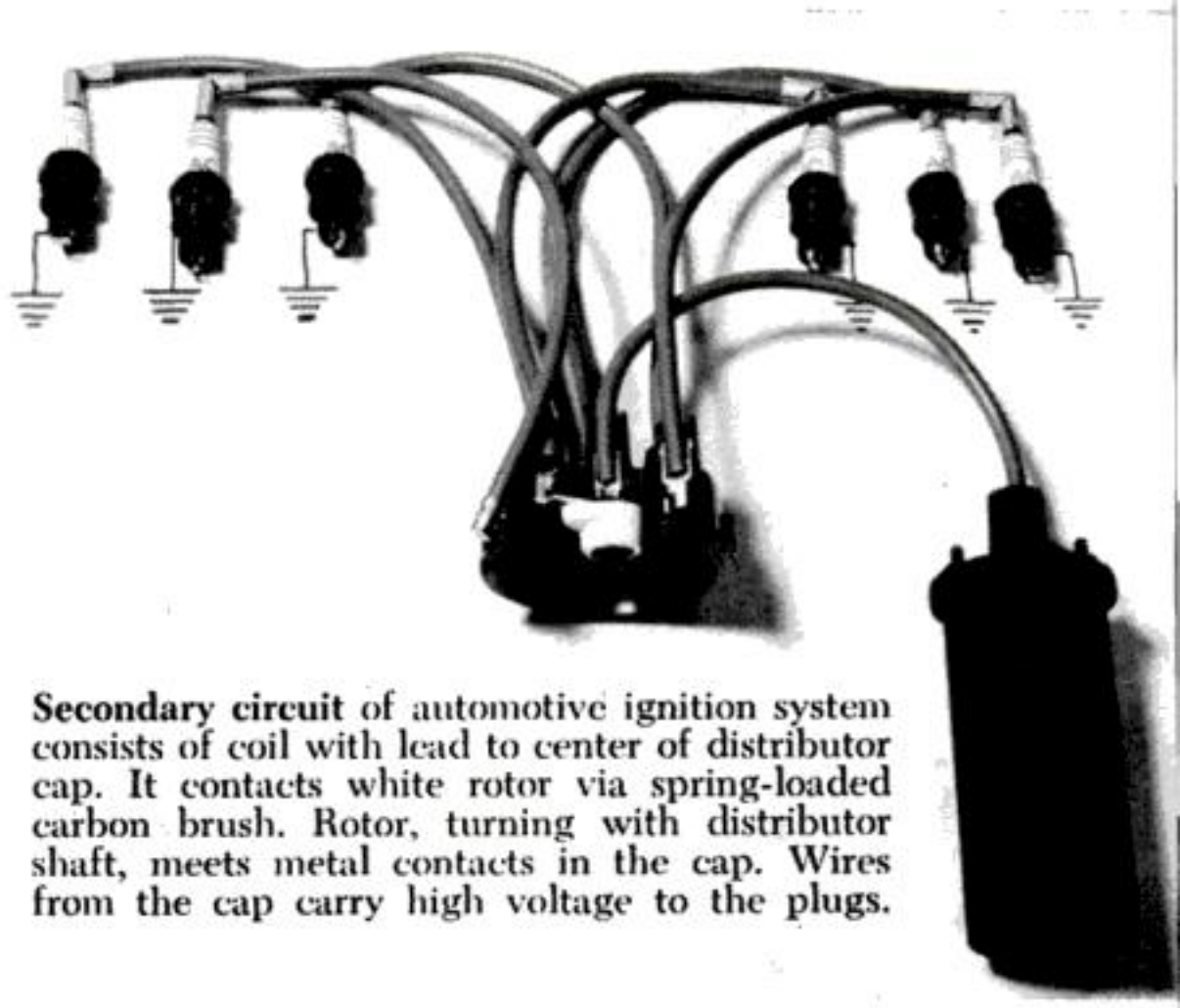
Many of us remember, or have seen, the manual spark lever on cars such as the Model A Ford, which provided the only means for adjusting the engine timing during operation. With such manual control the driver felt the engine's reaction to load or even heard the rattle of detonation.

With a low-powered, slow-turning engine, he could adjust the distributor quickly *enough* to prevent knock on heavy load or increase the car's speed on light load. With the development of high-speed high-compression engines, a quicker, surer automatic means of spark control was needed.

The centrifugal advance. This was the first means of automatically varying the ignition timing to be used. The action of flyweights advanced the timing as engine speed increased, so that combustion could be completed by the time the piston reached the bottom of its power stroke.

But centrifugal advance, unaided, has shortcomings. At the same engine speed, the optimum timing advance for best gasoline mileage under light loads could not be used under heavy loads because of detonation.

Light or partial load on a gasoline engine usually means a partially closed throttle valve in the carburetor, and this makes



Secondary circuit of automotive ignition system consists of coil with lead to center of distributor cap. It contacts white rotor via spring-loaded carbon brush. Rotor, turning with distributor shaft, meets metal contacts in the cap. Wires from the cap carry high voltage to the plugs.

for changes in the combustion chambers.

On intake, the piston acts as a suction pump to pull in a fresh charge. When this fuel-air mixture is "throttled" (throttle disk partly closed), a full charge cannot be drawn into the cylinder, and volumetric efficiency suffers. The partial charge results in lower pressures in the cylinder during the power stroke, and under these conditions flame propagation tends to suffer. The additional spark advance that can be tolerated at this time helps compensate for the slower flame travel and reduced efficiency.

The vacuum advance. This system, which began to appear on some automobile engines in the early 1930s, provided the means by which the timing could be varied according to engine load. Since intake-manifold vacuum is high under light load (part throttle) and low under heavy load (wide-open throttle), a small vacuum cylinder is connected to the distributor so that the timing is advanced with a high vacuum (light load) and retarded with low vacuum (heavy engine load).

Although the breaker points are actually a part of the spark-producing system and not the spark-distributing or timing system, they are involved in the timing system three different ways:

1) Turning the distributor body to establish the initial timing setting actually rotates the points with respect to the distributor cam.

2) The very act of opening the points

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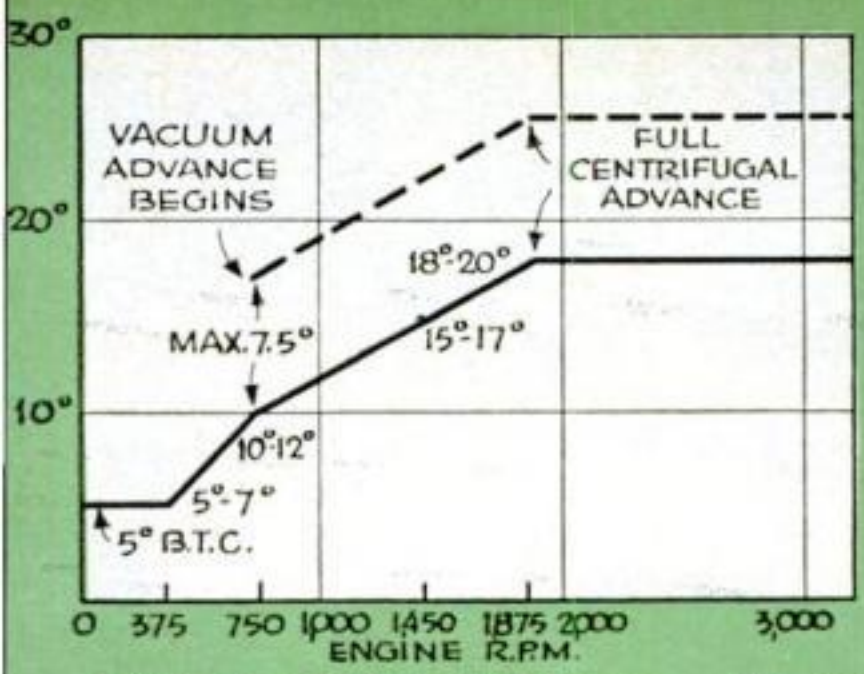
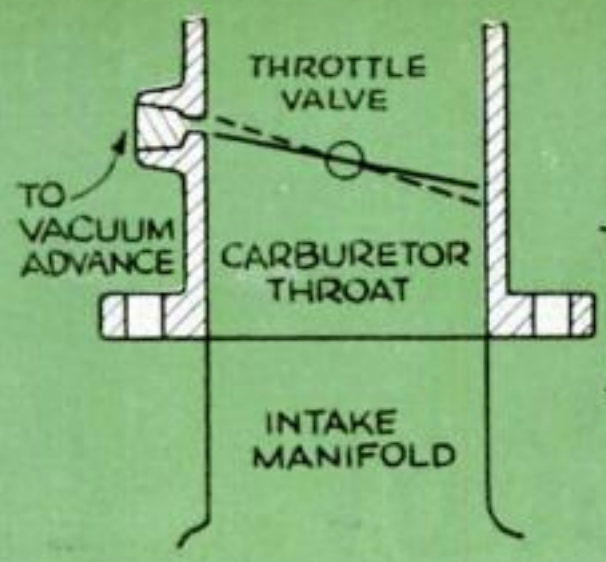
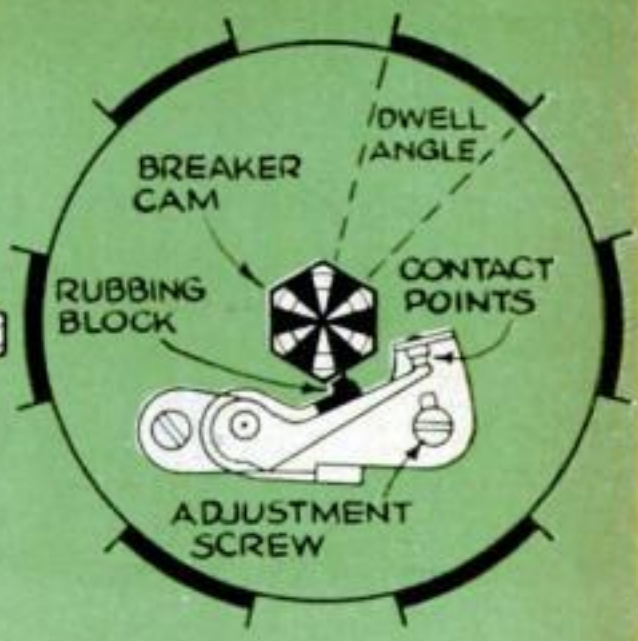


Automatic spark control is combination of centrifugal and vacuum advance. Graph shows effect on distributor with a vacuum advance of 7.5 degrees.



To avoid overadvancing spark as engine idles, producing high vacuum, vacuum-line connection to distributor is located so it is shut off by closed throttle.



Dwell angle for six-cylinder Chevy is indicated by dark segments (26-33 deg.), when the rubbing block is on low spots and points "dwell" together.

to produce the spark also establishes the point at which the spark occurs.

3) Distributor dwell angle can cause the points to affect timing. Opening and closing the distributor points alternately produces and collapses a magnetic field in the coil, and each time a high-voltage pulse is developed in the coil secondary.

The dwell angle. This is simply the time —expressed in degrees of distributor-cam rotation—that the distributor points "dwell together" (remain closed). Closing the point gap increases the dwell angle; opening the point gap decreases it.

An increase in dwell angle delays the opening point and this, of course, retards the ignition timing. Wear on the rubbing block, which runs against the cam, is the common cause of gradual point-gap decrease. This, in turn, retards the initial timing point.

To insure correct dwell angle, you need merely make certain that the nylon or fiber rubbing block of the points rests on the highest point (lobe) of the distributor cam. Then loosen the screws that fasten the stationary contact point to the distributor base plate. Insert a shim or point gauge to establish the correct gap—0.16″ for most cars—and retighten the screws to lock in the adjustment that insures proper dwell angle.

Timing is set by relating crankshaft position (and thus the position of the pistons in their cylinders) to the occurrence of a spark at No. 1 cylinder. A series of timing marks on the flywheel, or on a plate next to the harmonic balancer, align with a stationary pointer at the flywheel-housing peephole or a scribed mark on the rotating balancer. The marks may be concealed by dirt, but some digging around will usually reveal the degree scale or pointer (see photo on page 125).

It is possible to turn an engine over by hand until the pointer or scribed mark is aligned with the correct degree mark, and then turn the distributor until the points just begin to open. However, there is a much easier way.

Throwing light on the subject. Numerous stroboscopic lights are available. They utilize the high-voltage pulse at No. 1 spark plug while the engine is running to produce a brief but intense flash, which is directed toward the timing mark. Since the mark can only be seen when No. 1 cylinder fires, it appears to remain motionless with respect to the stationary portion (pointer or scale).

At this point, it is an easy matter to loosen the distributor clamping device slightly and turn the distributor body until the desired initial timing point is obtained.

In addition to adjusting the cylinder firing point automatically, the timing system must provide a means of establishing the firing order of the cylinders. The distributor rotor, turning at half engine speed (in four-cycle engines) inside the distributor cap, connects the ignition-coil secondary winding (high-voltage side) with each cylinder in the sequence established as the firing order for your particular engine. ■ ■

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Make perfect photocopies in less than a minute!

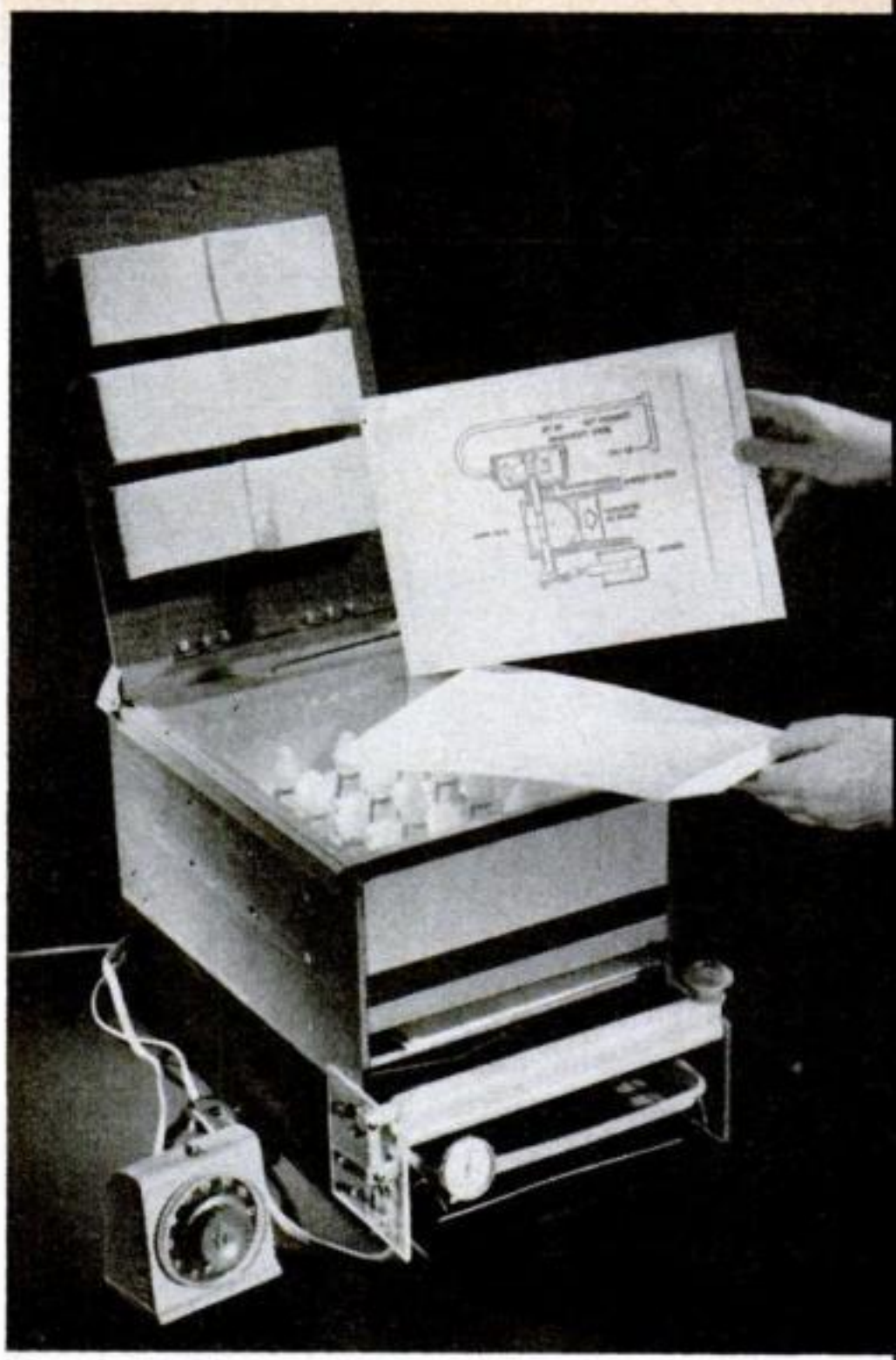
A Copy Machine You Can Build

It's a perfect weekend project. The photos at right show you how easy it is to use it

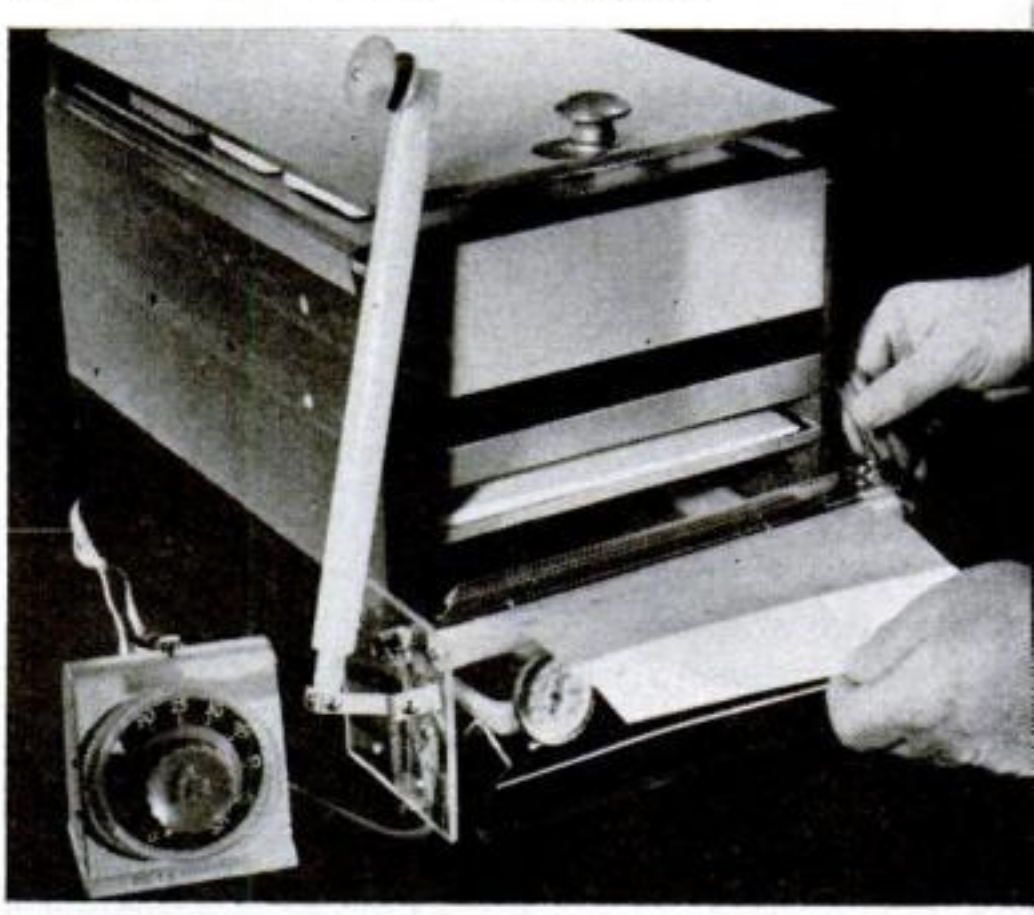
By Ronald M. Benrey

HERE'S a home-brew copying machine that will rival the performance of office photocopiers costing hundreds of dollars. It uses Kodak Verifax "matrix paper"—a sandwich of sensitized layers bonded to a paper backing.

Almost anything printed, typed, drawn, or written can be copied by placing it on the shiny side of a sheet of matrix paper. The matrix paper is exposed by shining a strong white light at its paper backing. Then the exposed matrix paper is developed in a special solution. Finally, the developed matrix paper is pressed against a sheet of "copy paper" (slightly absorbent bond paper). When the matrix paper is peeled away, a perfect copy of the original remains on the copy paper.



1 Here's how to make a copy: Place a sheet of "matrix paper"—with its shiny side up—on the light box. The original you're copying goes face down on the matrix paper.



3 Immerse the matrix paper in the developing solution for 30 seconds; hold it by its blank "tab," and pass it between the raised squeegee and the bottom roller.

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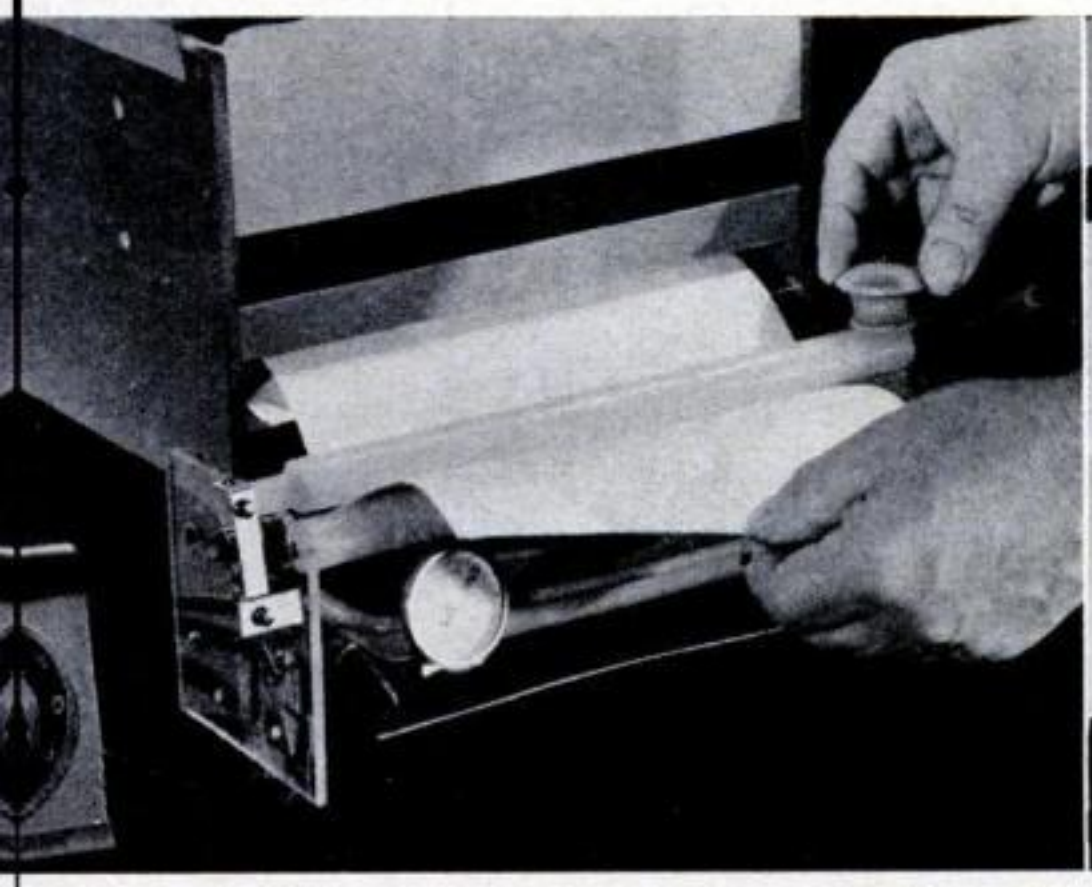
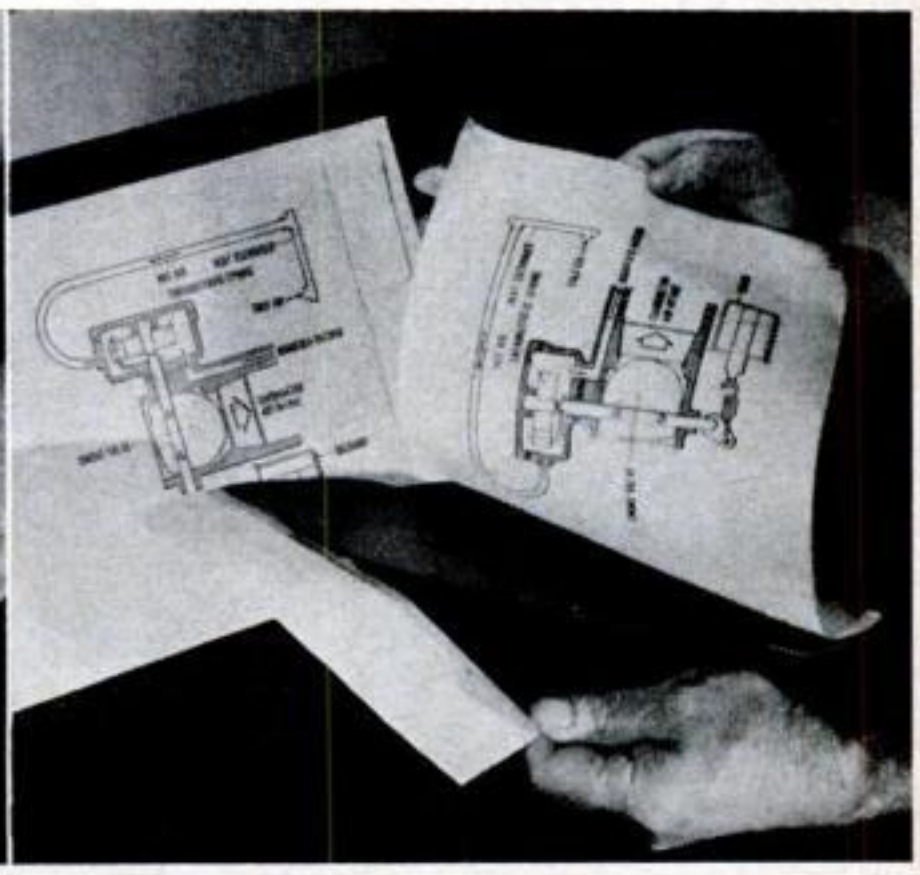
2 Expose the matrix paper for about 15 seconds (a shorter exposure darkens the final copy; a longer one lightens it). A photographic-enlarger timer is convenient for this, but you can cut costs by using a simple push-button switch to control the bank of light bulbs. Just count to yourself to gauge the number of seconds of exposure time.





4 Slide out a sheet of copy paper from the paper shelf. Press it against the developed matrix paper by drawing the pair together between the plastic rollers.

5 Peel away the copy paper carefully from the matrix paper, and set it aside a few minutes to dry. Once dry, your duplicate is permanent, and won't fade as it ages.

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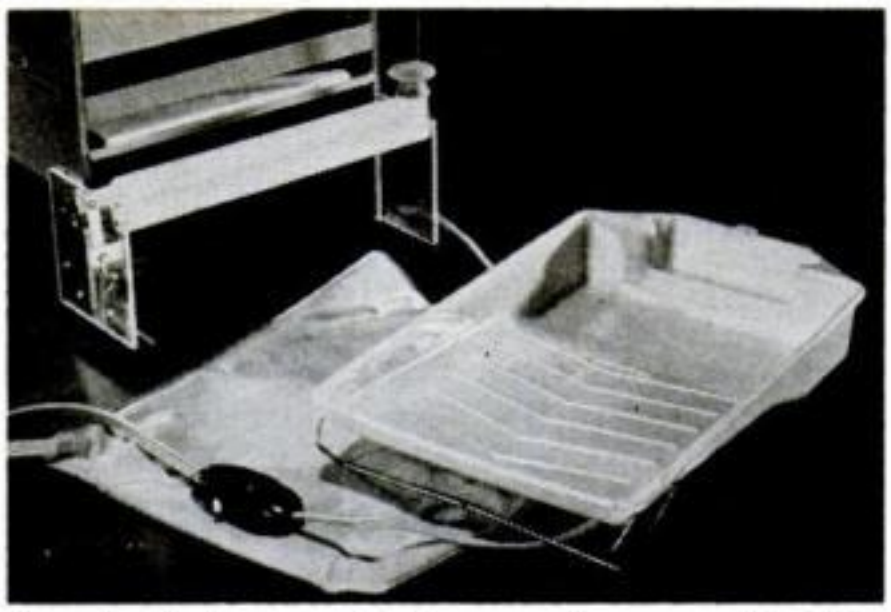
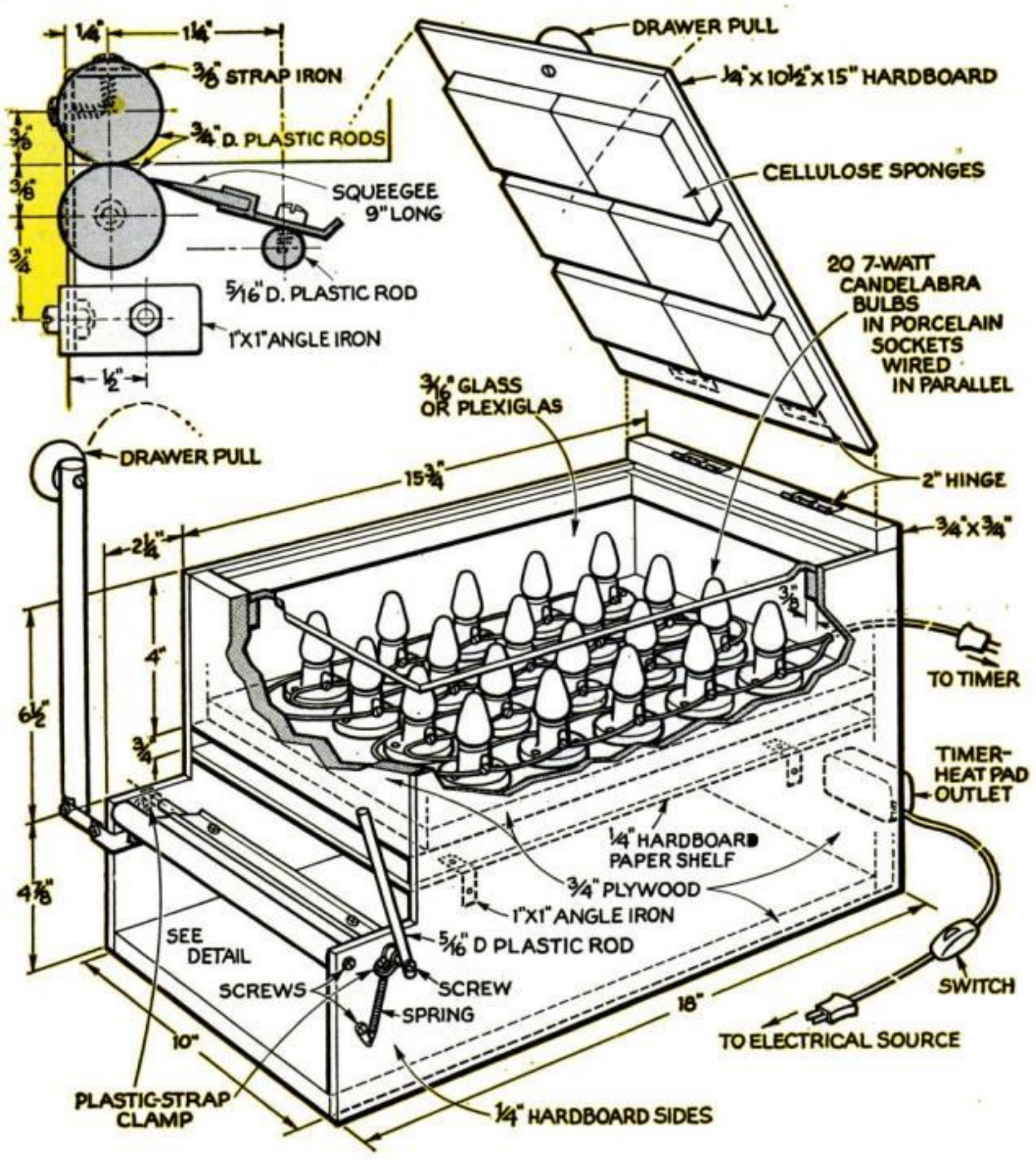


A polyethylene paint tray makes a perfect developing-solution tray. Don't use a metal tray; it will corrode quickly. An electric heating pad warms the solution to 82 degrees F.

If "multiple-copy" matrix paper is used, it can be re-immersed in the solution and up to eight copies can be made. Single-copy matrix paper costs eight cents a sheet; multiple-copy, nine cents. Adding up all supplies, single copies cost about nine cents each, but for several copies of the same thing, cost drops to about 1½ cents each. Check your yellow pages under "copying machines" to find a dealer who stocks matrix paper, copy paper, and solution.

Building the box. Start by assembling the plywood bottom, back, and bulb shelf into a rigid frame.

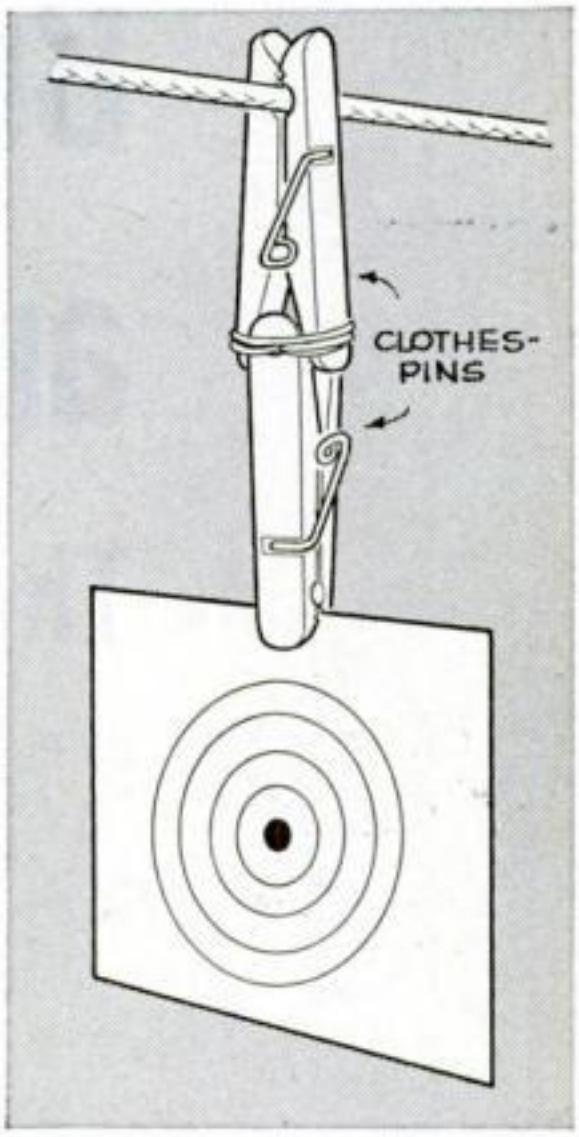
[*Continued on page 210*]

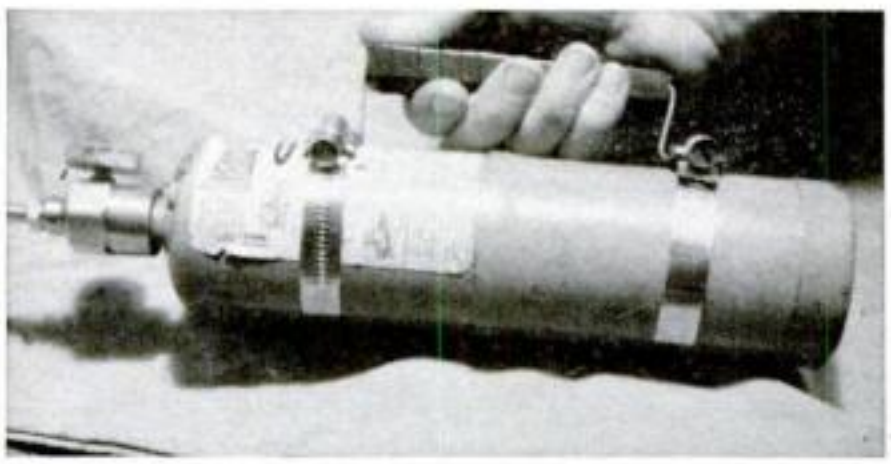


Urheberrechtlich geschütztes Material

Endless clothesline carries target down range

A large basement room is a good place for an interior pulley-operated endless clothesline since it can also serve as the target carriage for an air-rifle range. Attach the cardboard target to the line with two spring-loaded clothespins as shown at right. The setup saves a lot of walking.—*Ken Murray, Colon, Mich.*





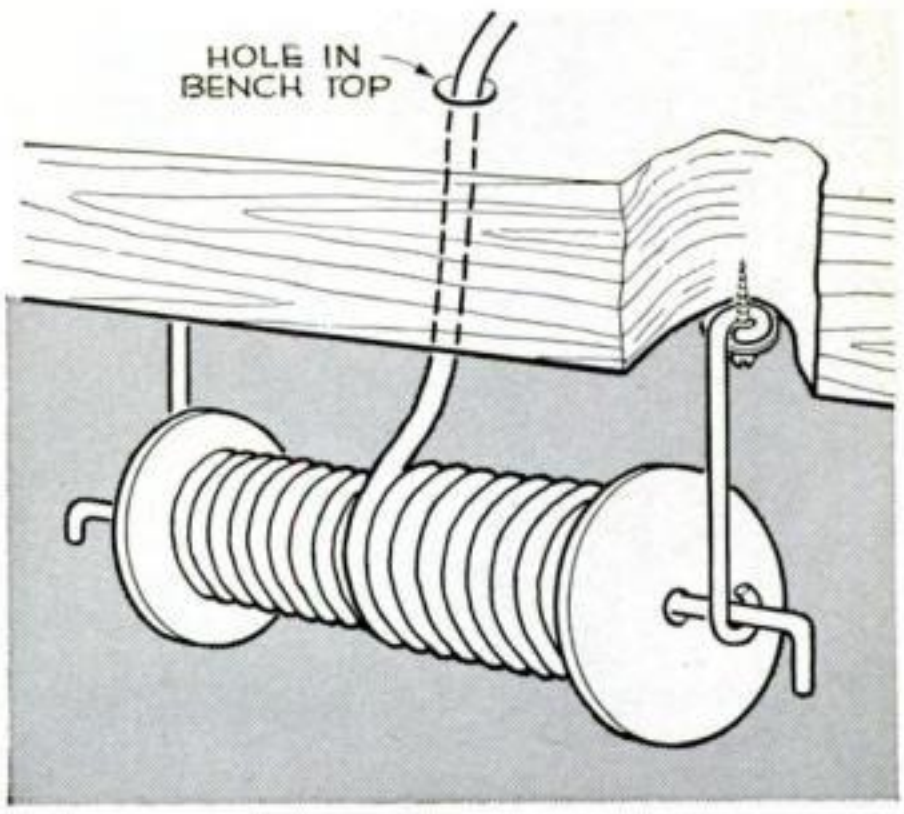
A handle is handy on a butane torch

Finding my butane torch tiring to hold by its tank, I made the small handle that you see in this photo. You can do the same by bending coat-hanger wire or a strip of flat metal. After shaping the handle, tape on two pieces of flat wood where your hand grips it, and attach it to the tank with hose clamps.—*Peter Legon, Malden, Mass.*

Solder feeds up through workbench

By supporting a spool of solder on wire hangers out of sight under the surface of a workbench, and running the wire up through a hole, you'll always have solder within easy reach when a soldering job comes along. A bend in the wire will keep it from slipping through the hole.—*Daniel Bousha, Jackson, Miss.*

▶▶▶ When you're doing a finicky paint job and you're out of masking tape, spread a thin coating of petroleum jelly over the areas you want to keep paintfree. Any paint spatters then will wipe off readily when you've finished the job.



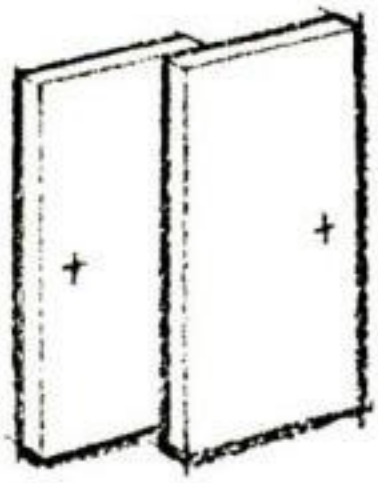
Urheberrechtlich geschütztes Material

The ABCs of Building Chests and Cabinets

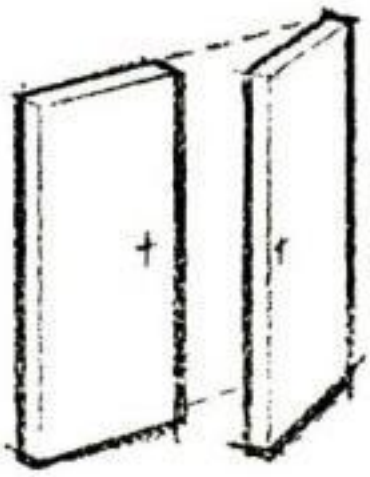
The four kinds of doors

By R. J. De Cristoforo

You have a choice of doors that . . .



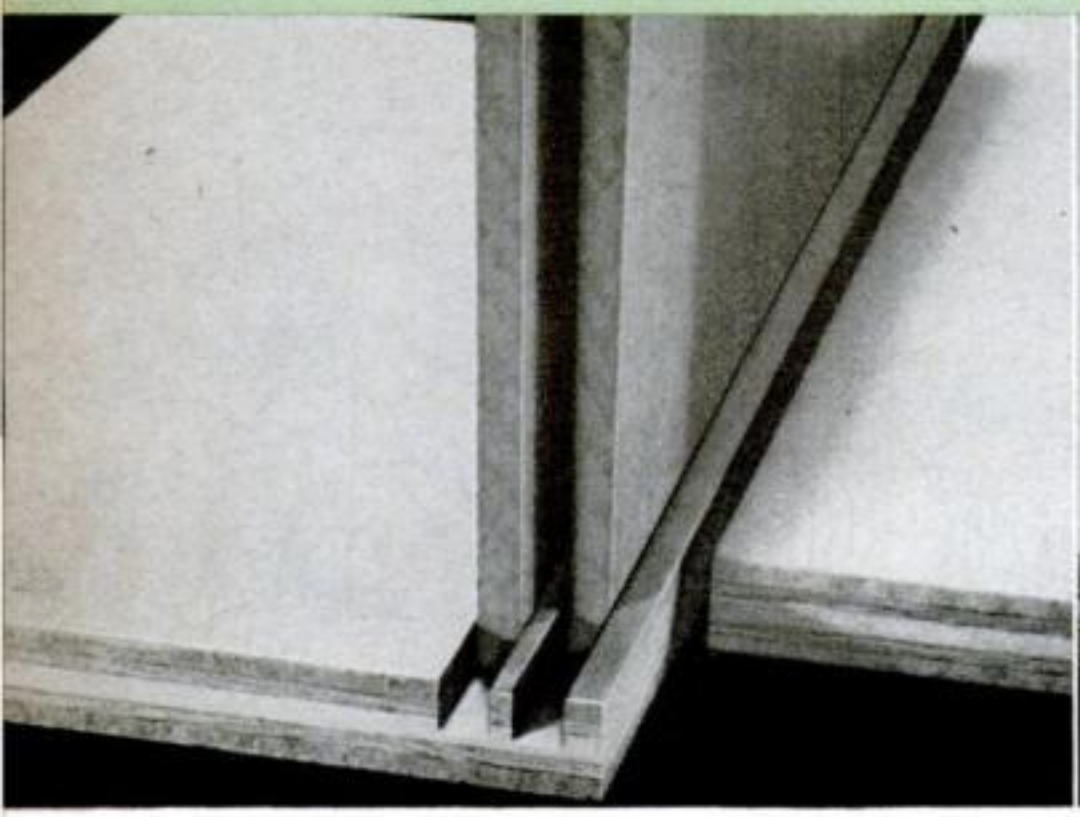
slide . . .



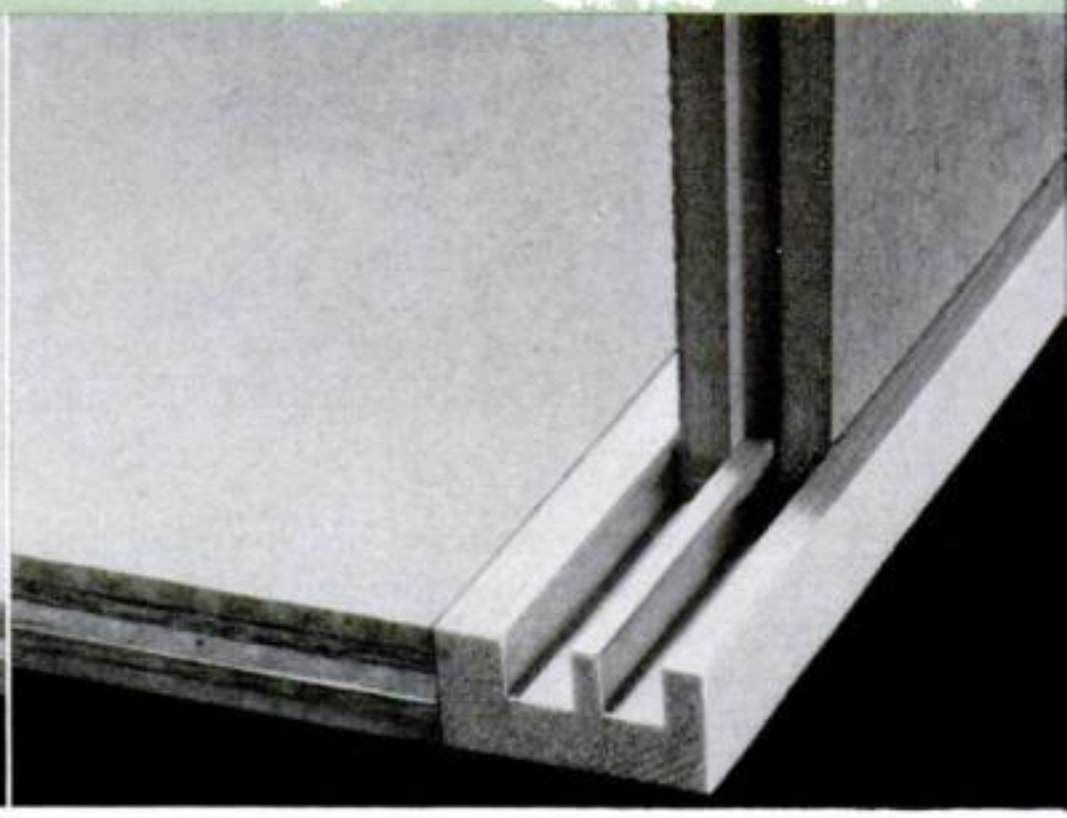
swing . . .

You can form sliding-door grooves in several ways

Twin grooves may be formed in the case itself at top and bottom. Make them a bit wider than door thickness so the door won't bind.



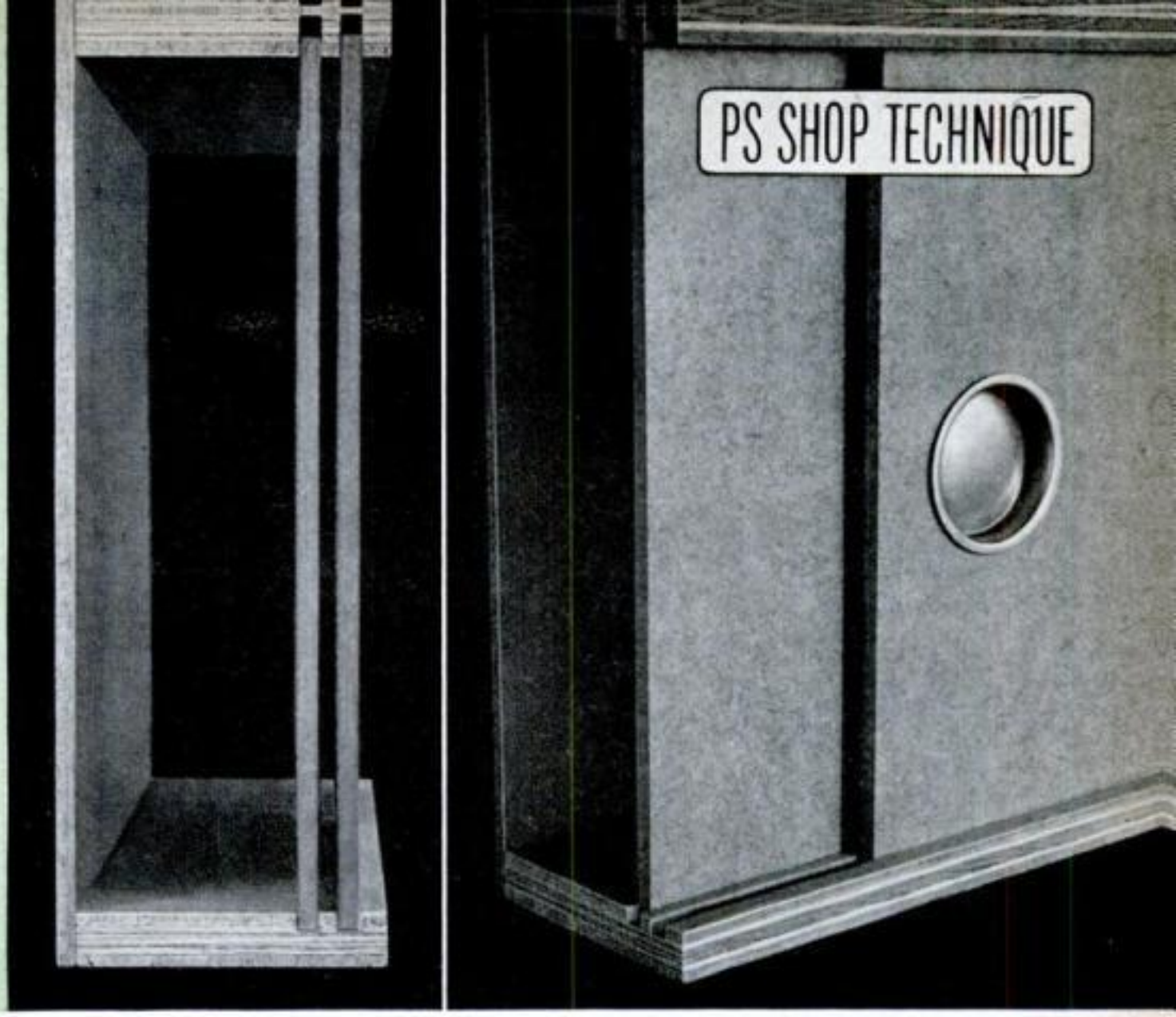
Grooves also can be cut in a frame which you then attach to front edge of **case. Or you** may buy metal tracks and attach **them in** same way.



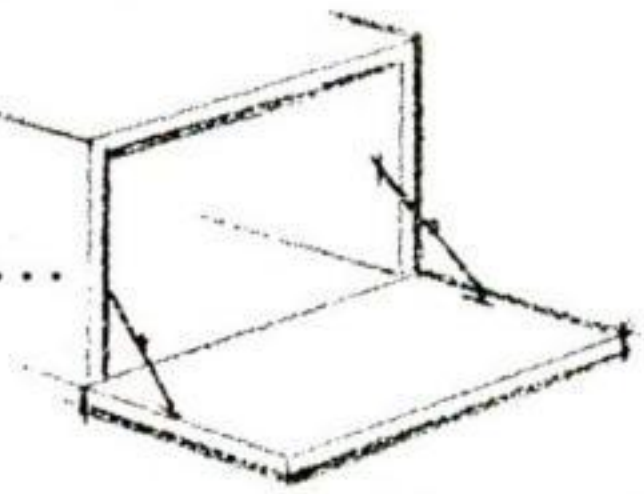
Urheberrechtlich geschütztes Material

The secret that makes sliding doors removable

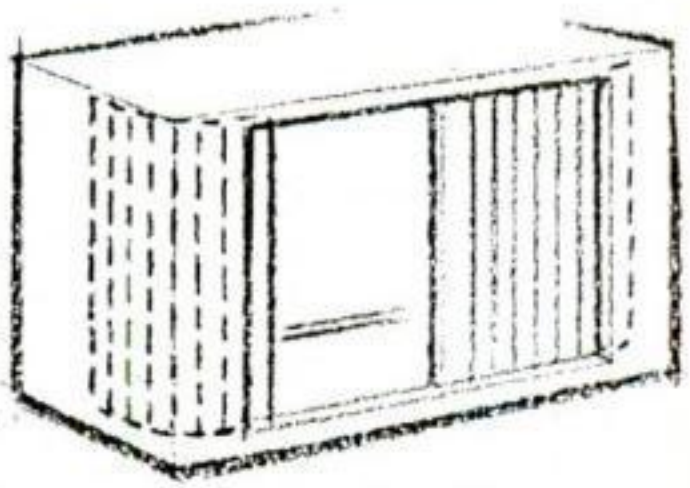
The top grooves for sliding doors are cut twice as deep as those at the bottom—as you see in these demonstration photos. You can then lift up the doors and pull them out of the cabinet for cleaning or for painting. Pulls are shallow cups forced snugly into holes drilled in the doors. This lets doors bypass each other. It's usually best to install a pull at each end of each door section.



drop . . .



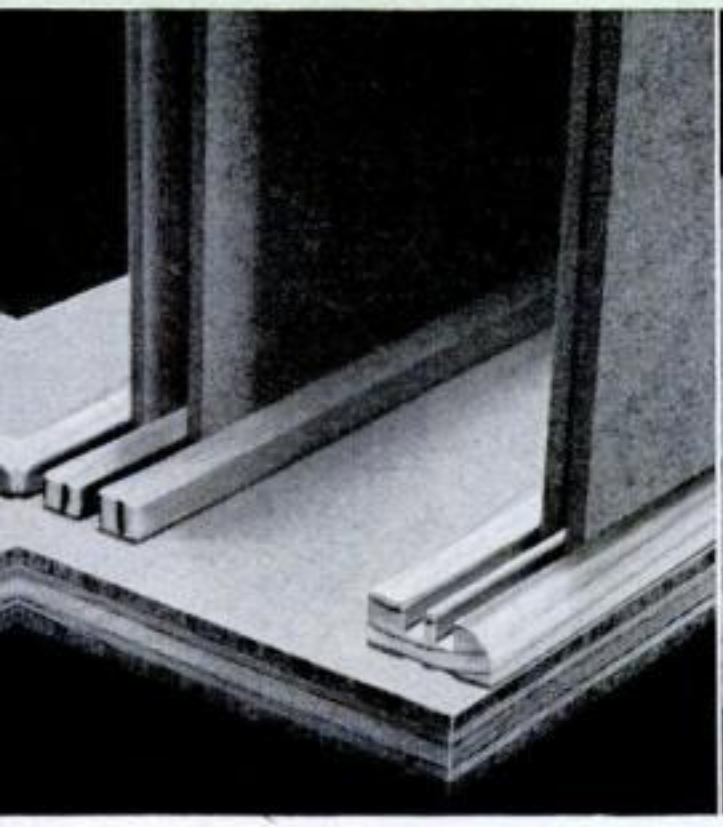
or disappear inside the chest.

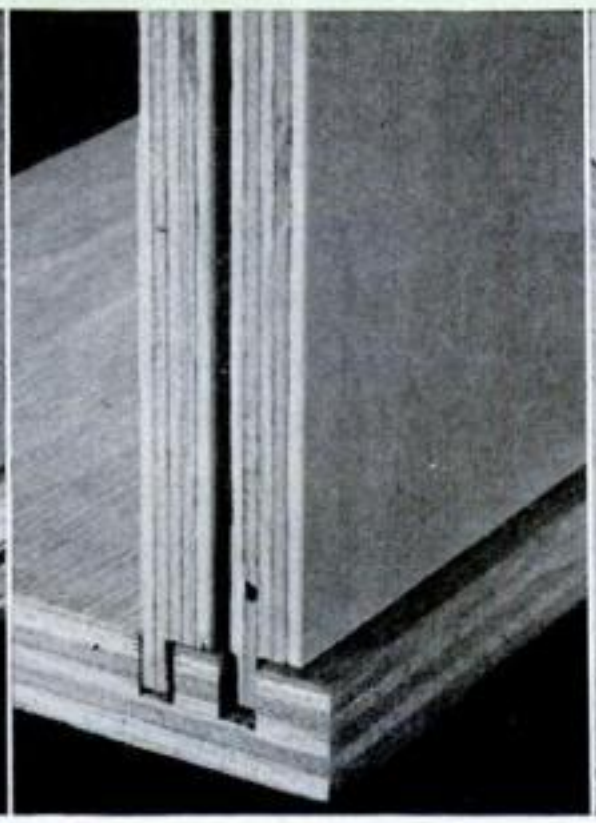


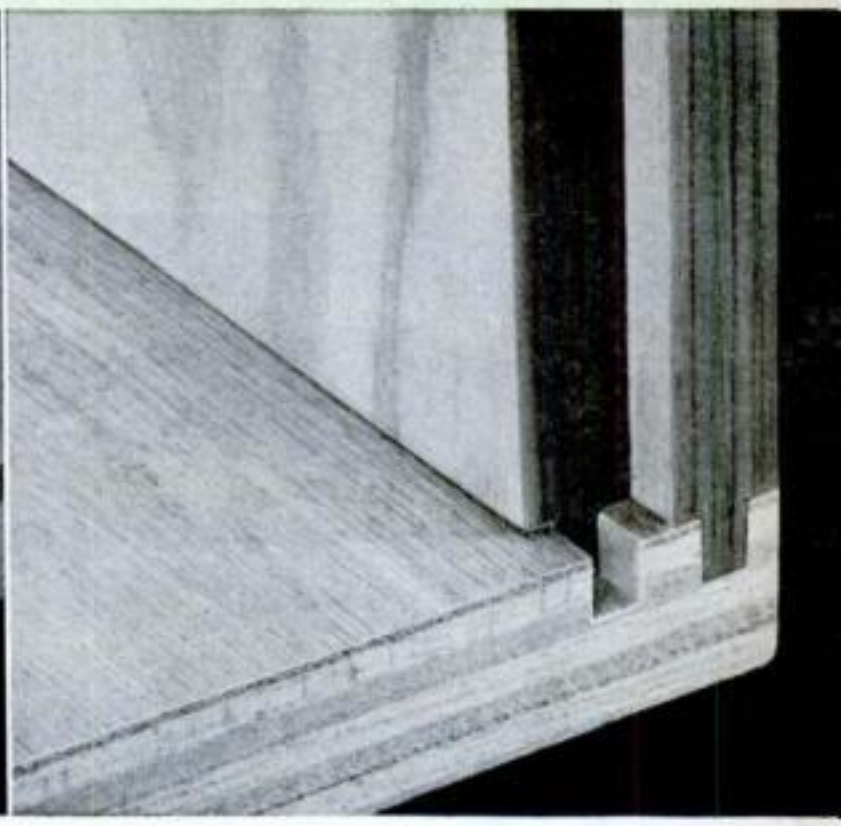
Surface-mounted wood strips are still another—and easy—way to create grooves. A grooved molding, made or bought, does the job easily, too.

Rabbeting the door edges, as you see below, saves space in the cabinet. But be sure to leave space between the doors so that they don't rub together.

Doors can be flush with the case edge if you use the system shown below. A rabbet cut, instead of a tongue cut, will accomplish the same thing.







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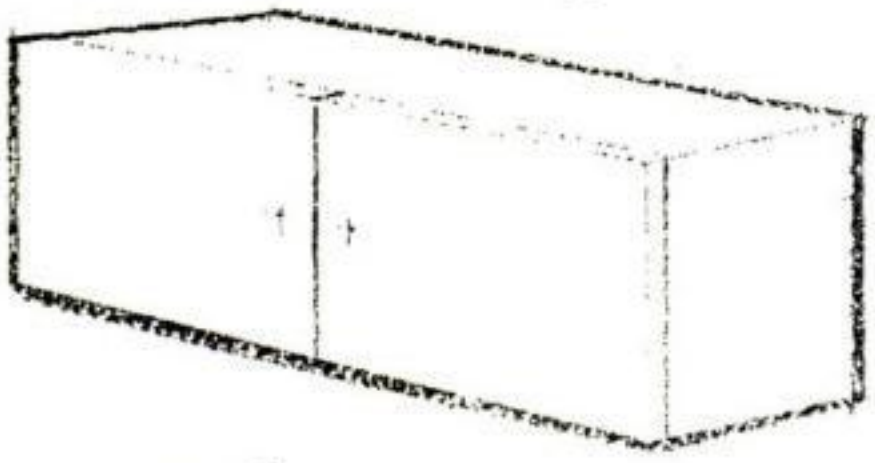
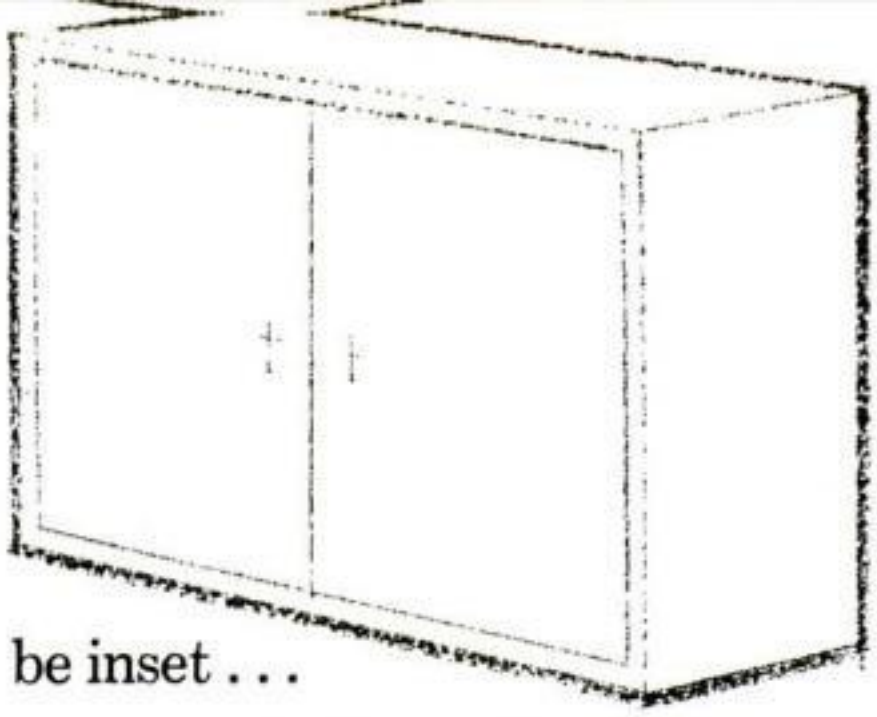
Urheberrechtlich geschütztes Material

Doors that swing...

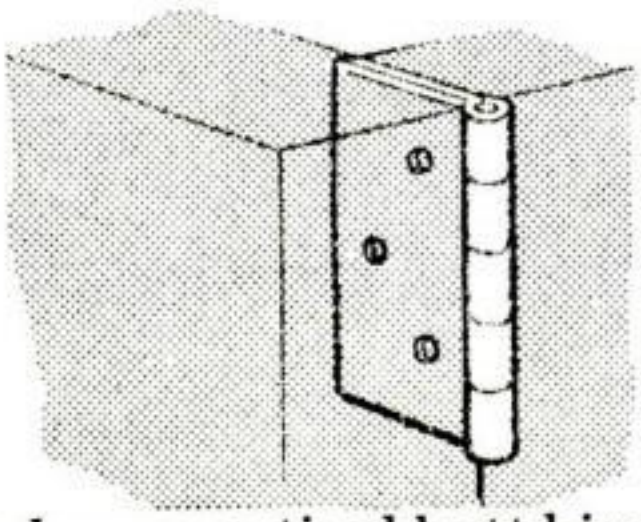


may overlap
the front edges of the case . . .

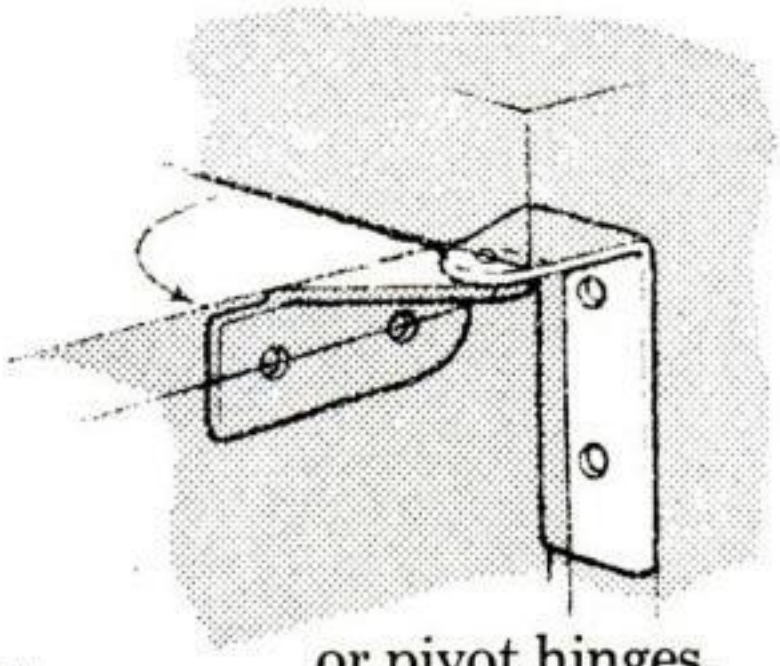


be inset . . .

Overlapped doors . . .

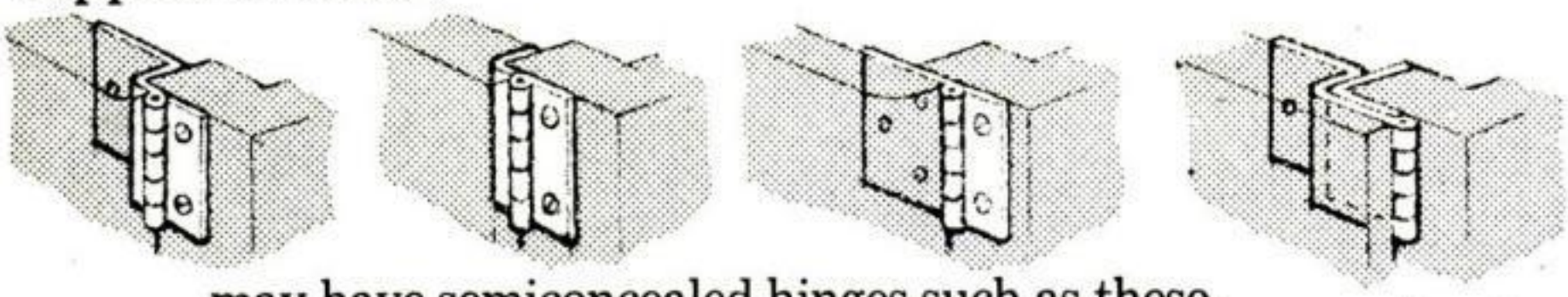


may have mortised butt hinges . . .



or pivot hinges.

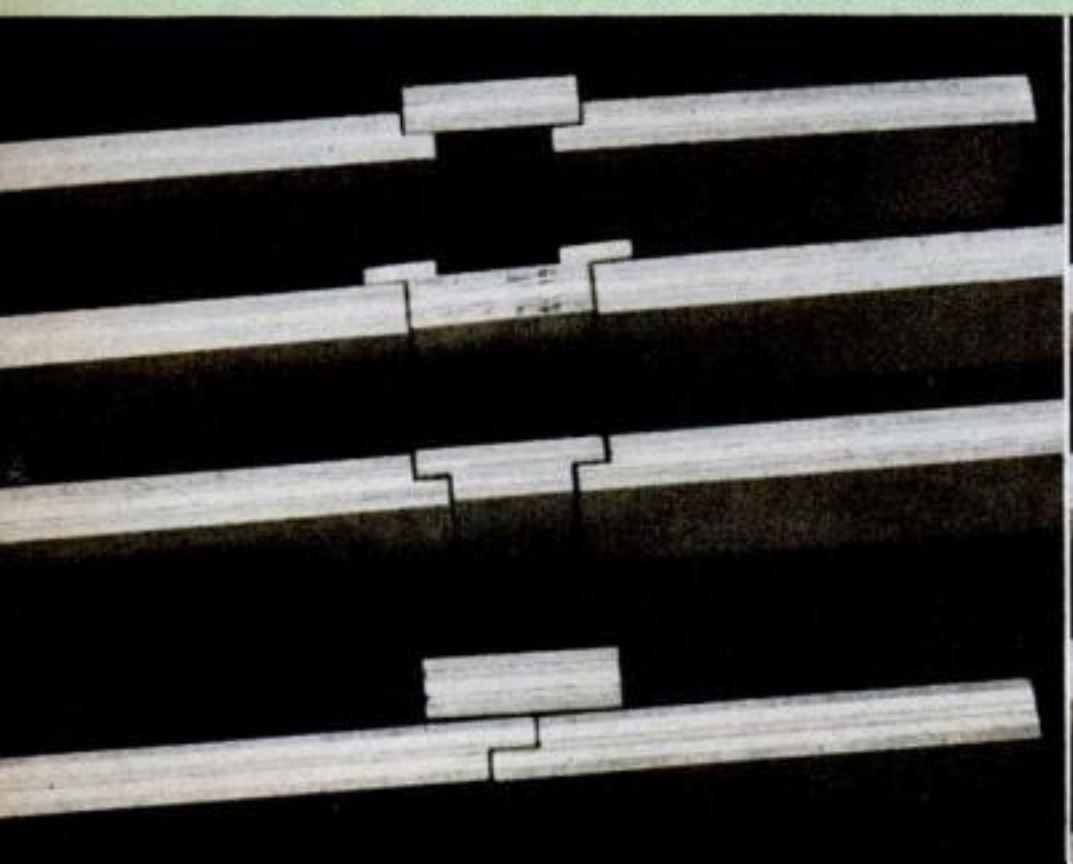
Lipped doors . . .



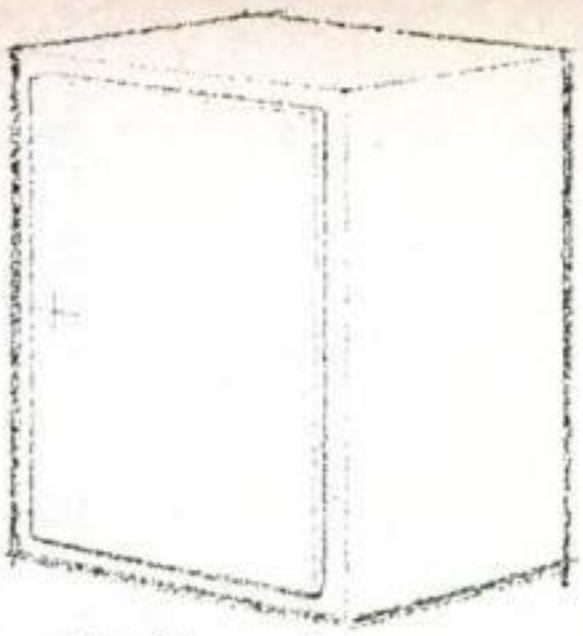
may have semiconcealed hinges such as these.

Center-stile stops for double doors can be formed as below: lipped doors against stile (top), flush doors against cleats, matched cuts on stile and doors, and matched door edges.

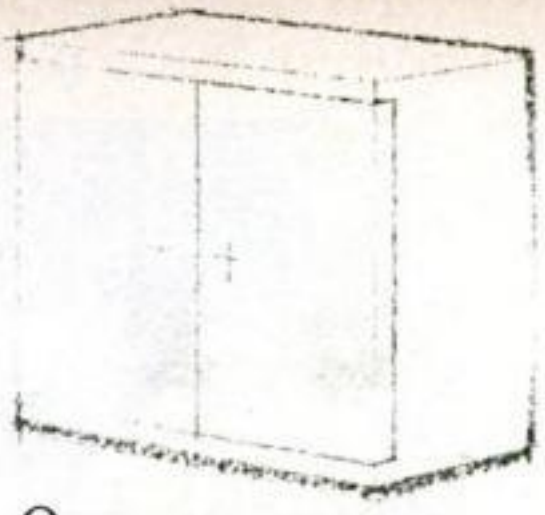
Stops for single doors can be formed in four ways (left to right): lipped door against case edge, flush door against cleat, overlap flush door against edge, rabbet cut in case edge.



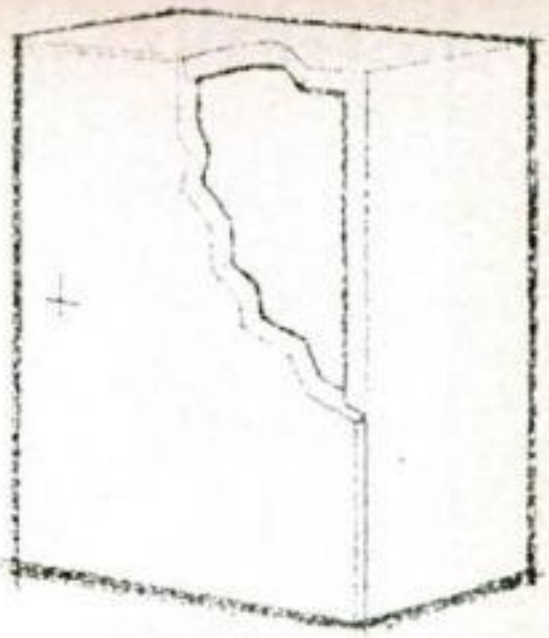
Urheberrechtlich geschütztes Material



or be lipped.

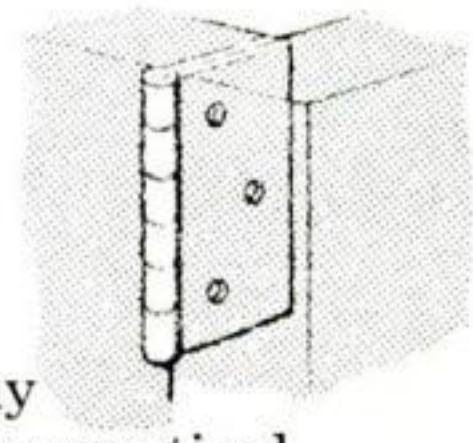


Or you may
prefer a combination:
overlap and inset . . .

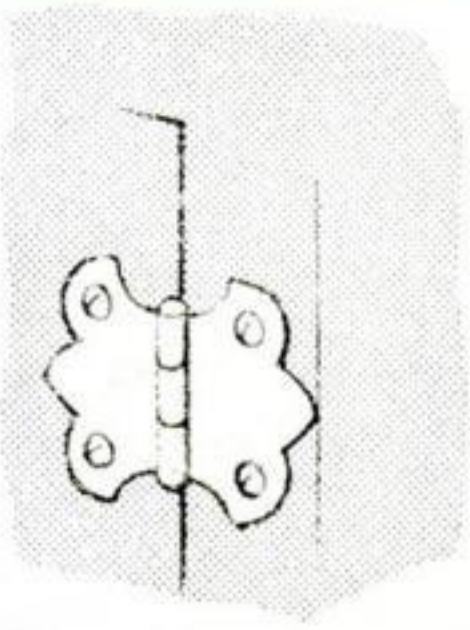


or full-lip overlap.

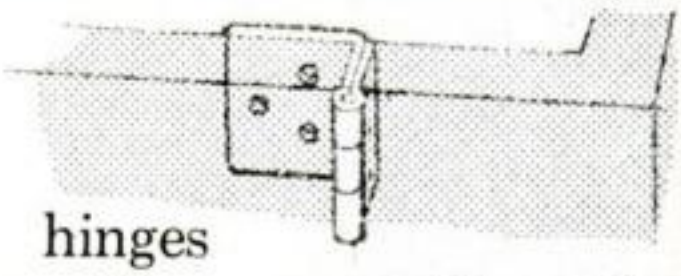
Inset doors . . .



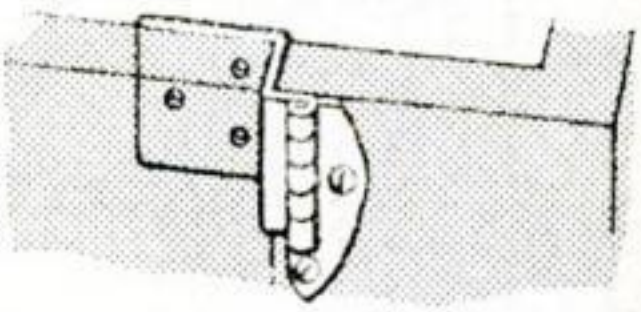
may
have mortised
butt hinges . . .



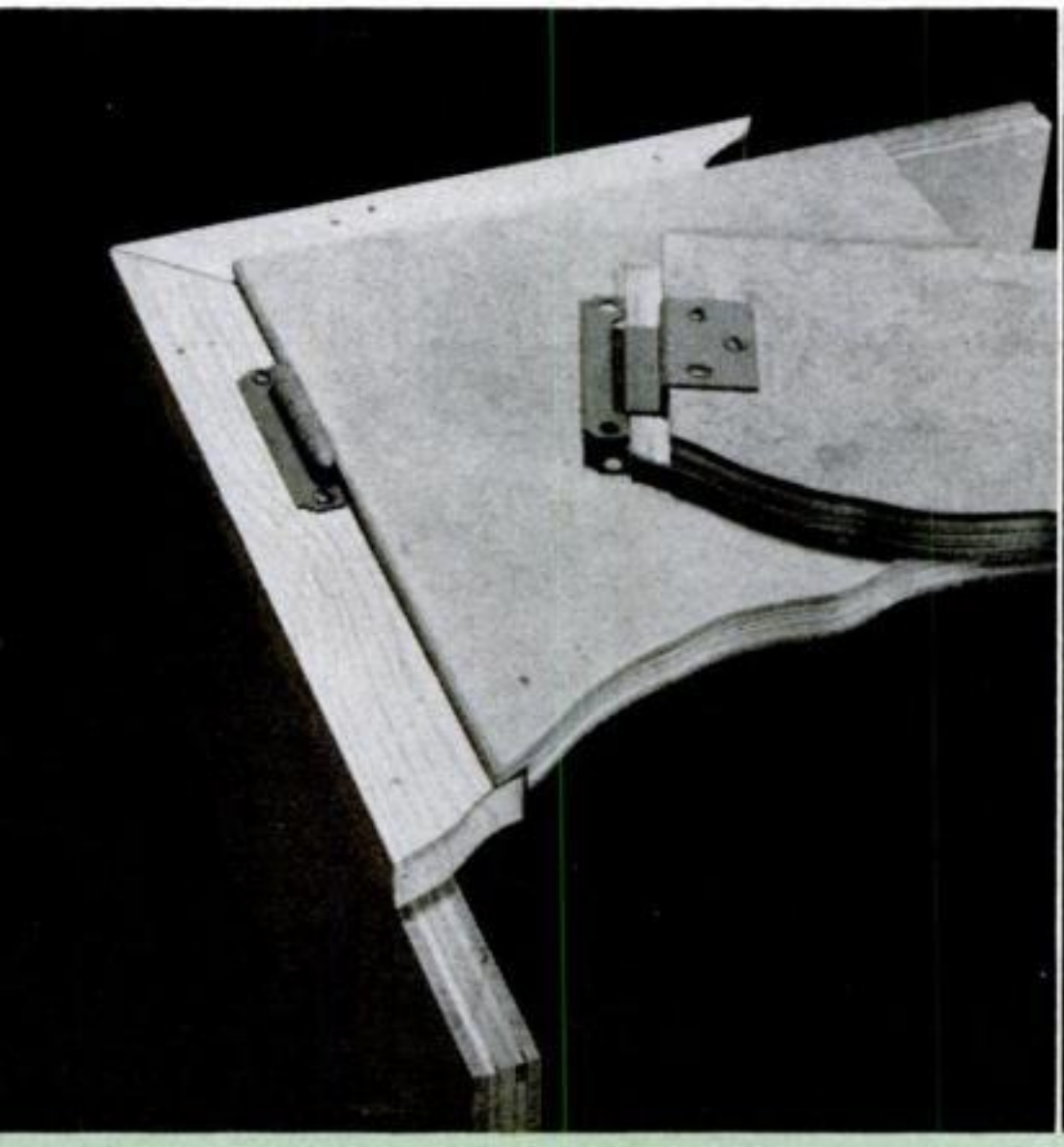
surface hinges . . .



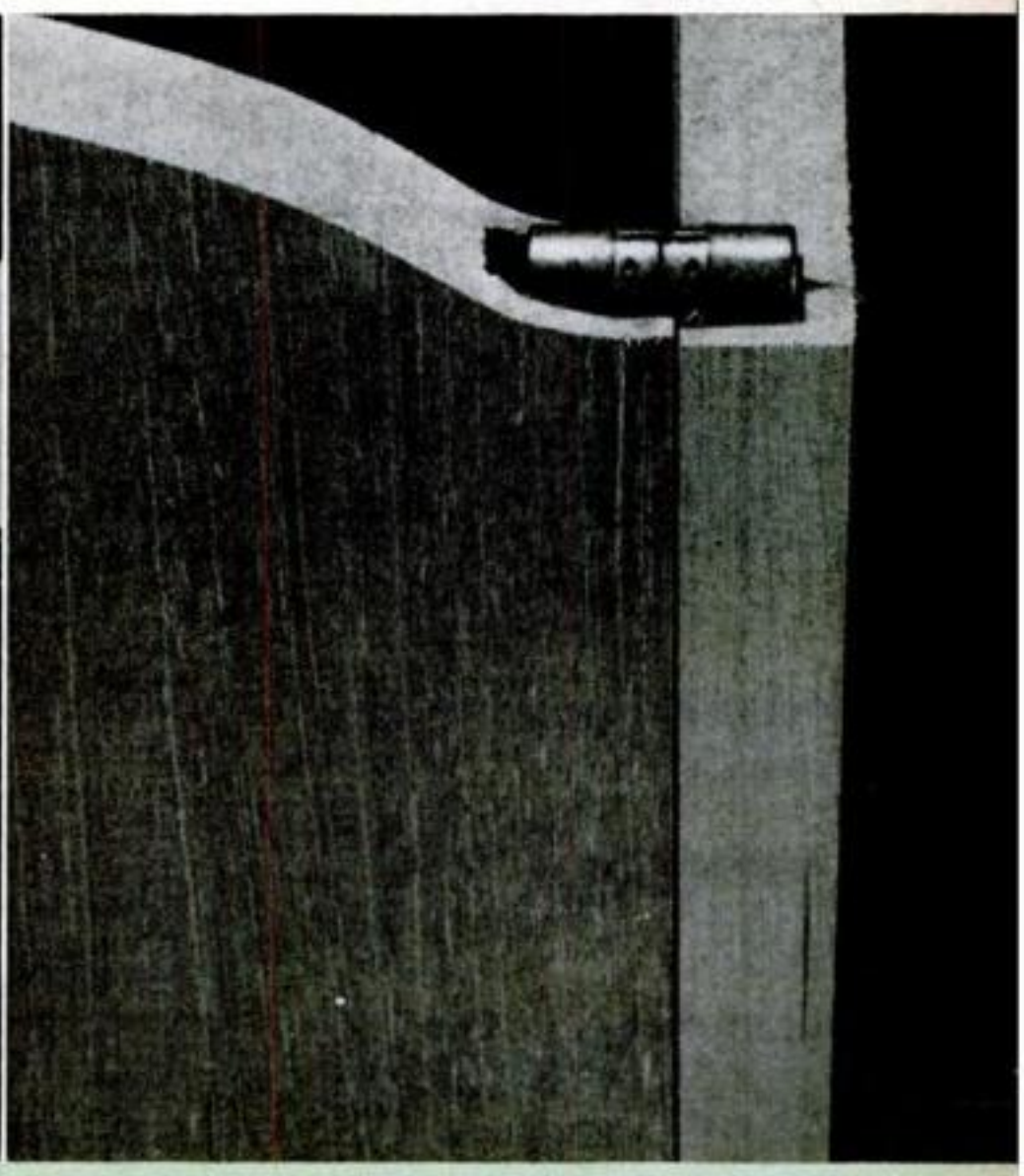
hinges
with an exposed barrel . . .



or semiconcealed hinges.



Offset hinge for lipped door like this one is made to fit specific rabbet in door edge. So it's best to buy the hinges before shaping the door.

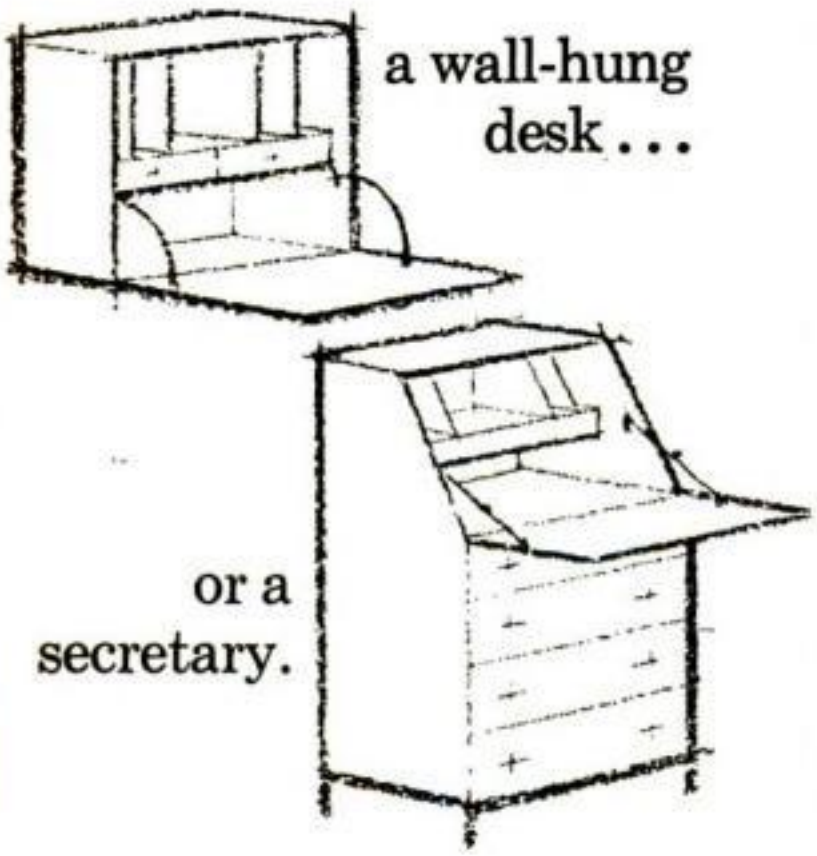


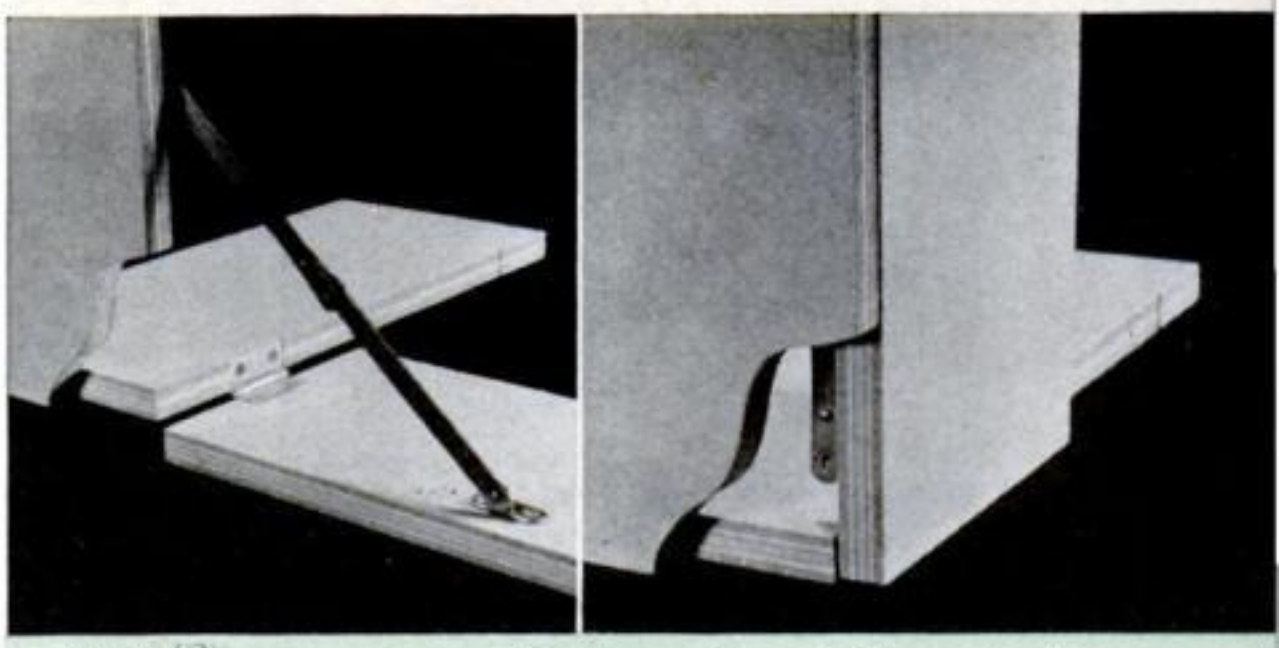
Fully concealed hinge like this one (Soss) can't be seen when inset door is closed. This type sits in holes; others require mortising.

CONTINUED

Urheberrechtlich geschütztes Material

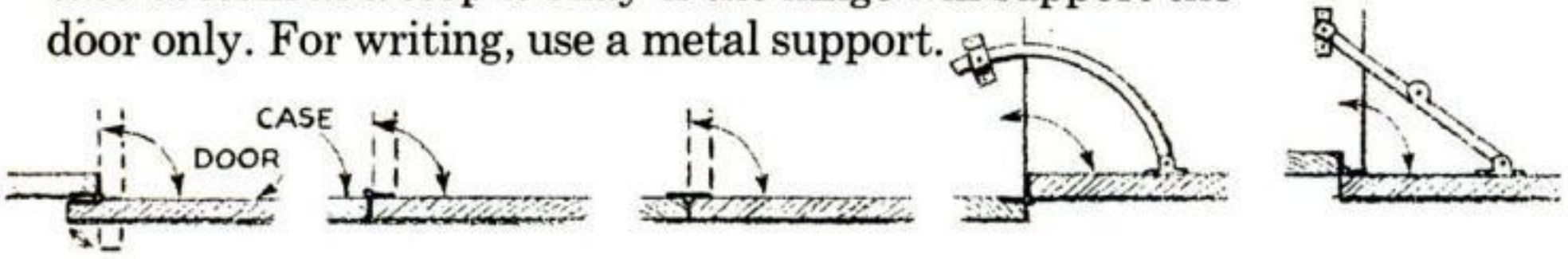
Doors that drop are useful on such projects as...



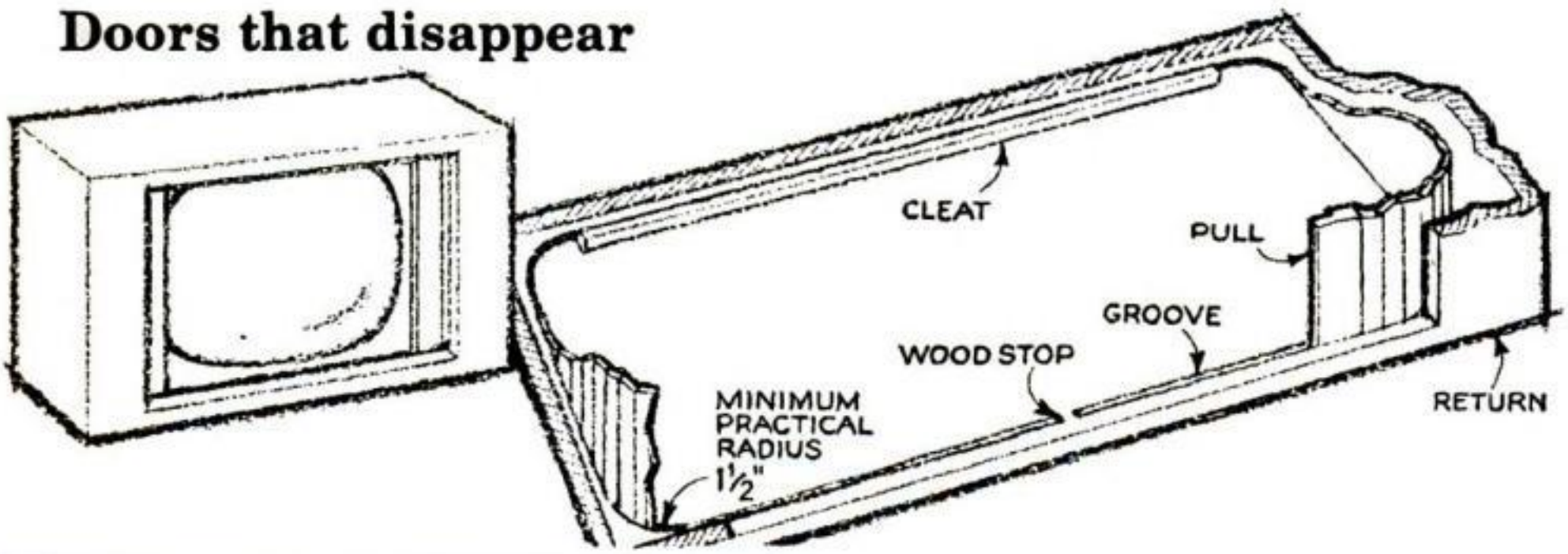


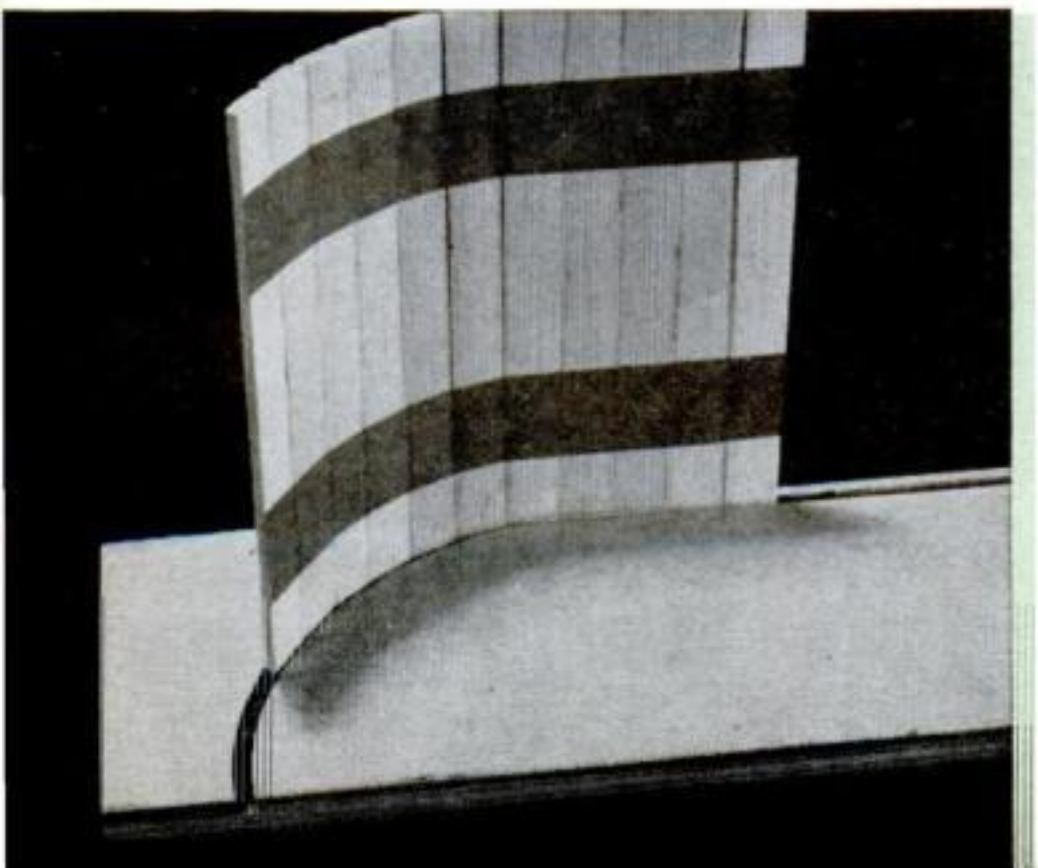
A fairly common setup for drop doors is shown in the photos above. Butt hinges and standard support hardware are used. Hinge isn't visible when door is closed. Side of case hides edges of closed door.

Five door-mounting methods are sketched here. Using the case bottom as a stop is okay if the hinge will support the door only. For writing, use a metal support.



Doors that disappear

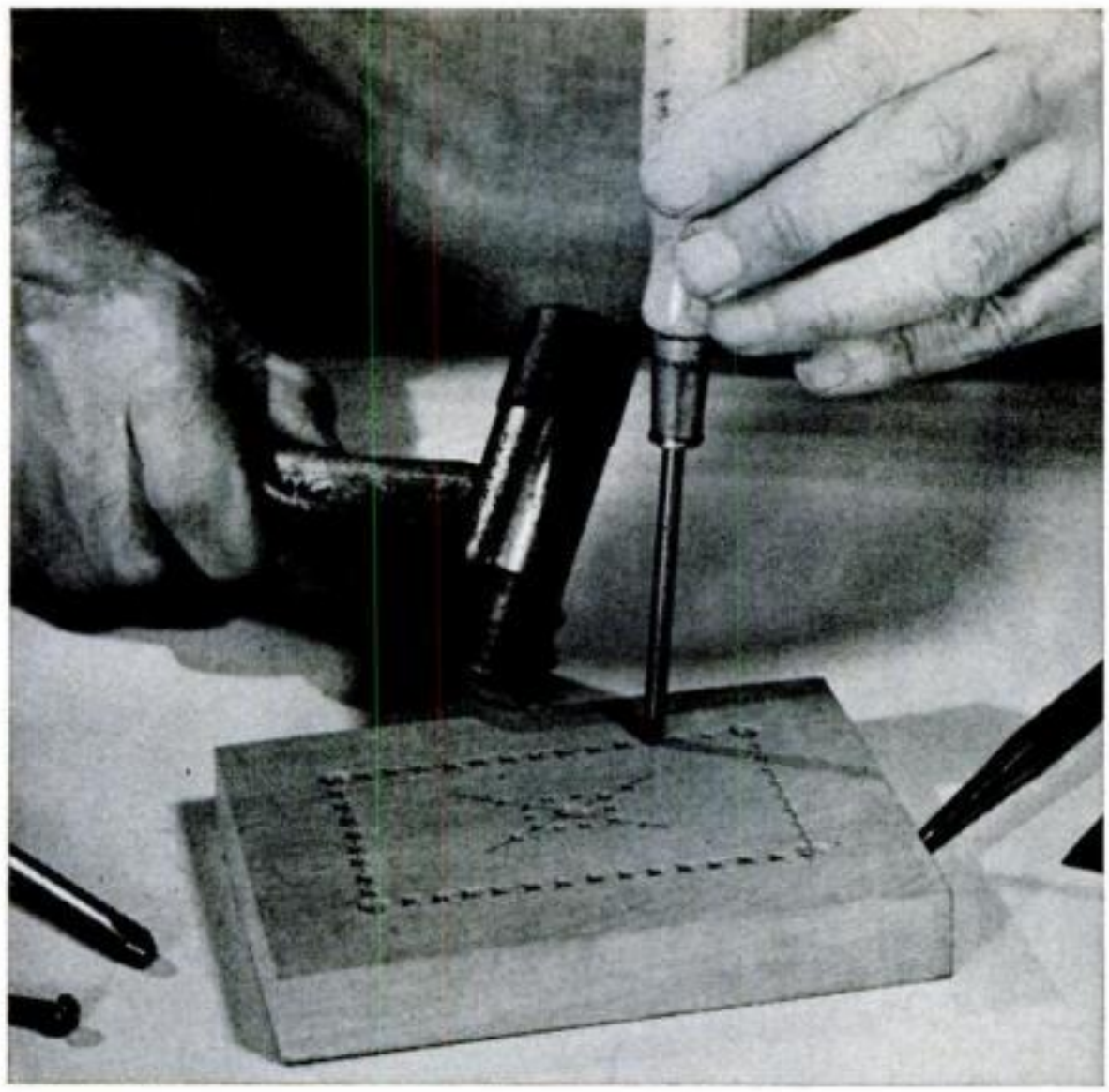




Doors that disappear (tambour doors) demand perfect matching of the curves in the top and bottom grooves. The narrower and thinner the slats, the smaller the curve radius can be, but a 1½" radius is about the minimum. A "return" at each side of the case front will hide the door travel. A small cleat at the rear will keep stored items out of the groove. A wood strip on one door will conceal the gap when doors are closed, also serve as a pull. Canvas usually is glued on the backs of the slats to keep the assembly flexible, but two strips of adhesive felt, available in dime stores, do the job nicely—as at left. ■ ■

Next month: Building the drawers

Urheberrechtlich geschütztes Material

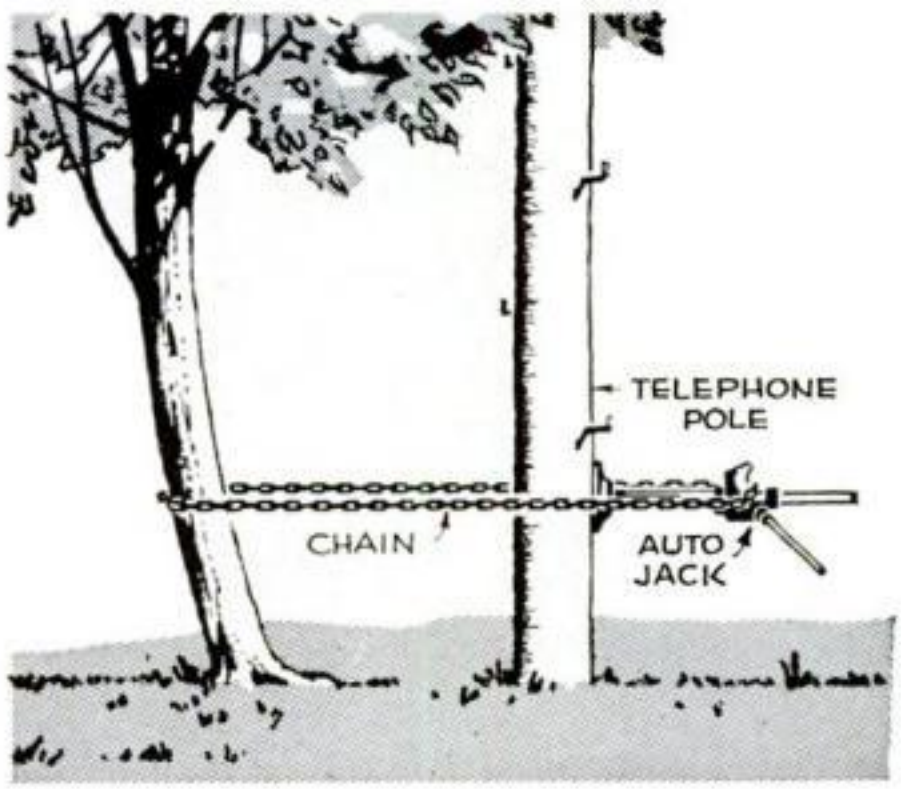


How to create wood designs with a screwdriver

A Phillips screwdriver and the screws it drives can be used as decorative punches to make designs on wood and other materials. The screwdrivers make indented crosses; size can be controlled to some extent by regulating the depth of punch marks. The screws make a rounded depression with a raised cross in the center. Hold the screw by inserting the point in small metal tubing.—*W. E. Burton, Akron, Ohio.*

▶▶▶ To repair a small hole in a fuel-oil tank, I emptied the tank, let it dry a half-hour, and wire-brushed the hole area with a weak solution of muriatic acid. I then stuffed a loop of wire-screening wires into the hole and used a heavy soldering iron (no flame!) to deposit a blob of solder on the wires.—*Ed Galloway, Pontiac, Mich.*

▶▶▶ Although a new hammer was well balanced and nicely finished, I couldn't seem to drive a nail without the hammer glancing off. So I cross-hatched the face lightly by holding it against a coarse grindstone to produce a series of lines at right angles to each other. Improvement was about 100 percent.—*A. Weber, Edmonton, Can.*



Car jack straightens a leaning tree

A large tree on my lawn was almost blown over during a hurricane. I straightened it by placing a car jack on a nearby telephone pole to pull against a loop of chain that reached around the tree, as above.—*S. N. Stresnic, Ft. Lauderdale, Fla.*

Try this trick with an oil can

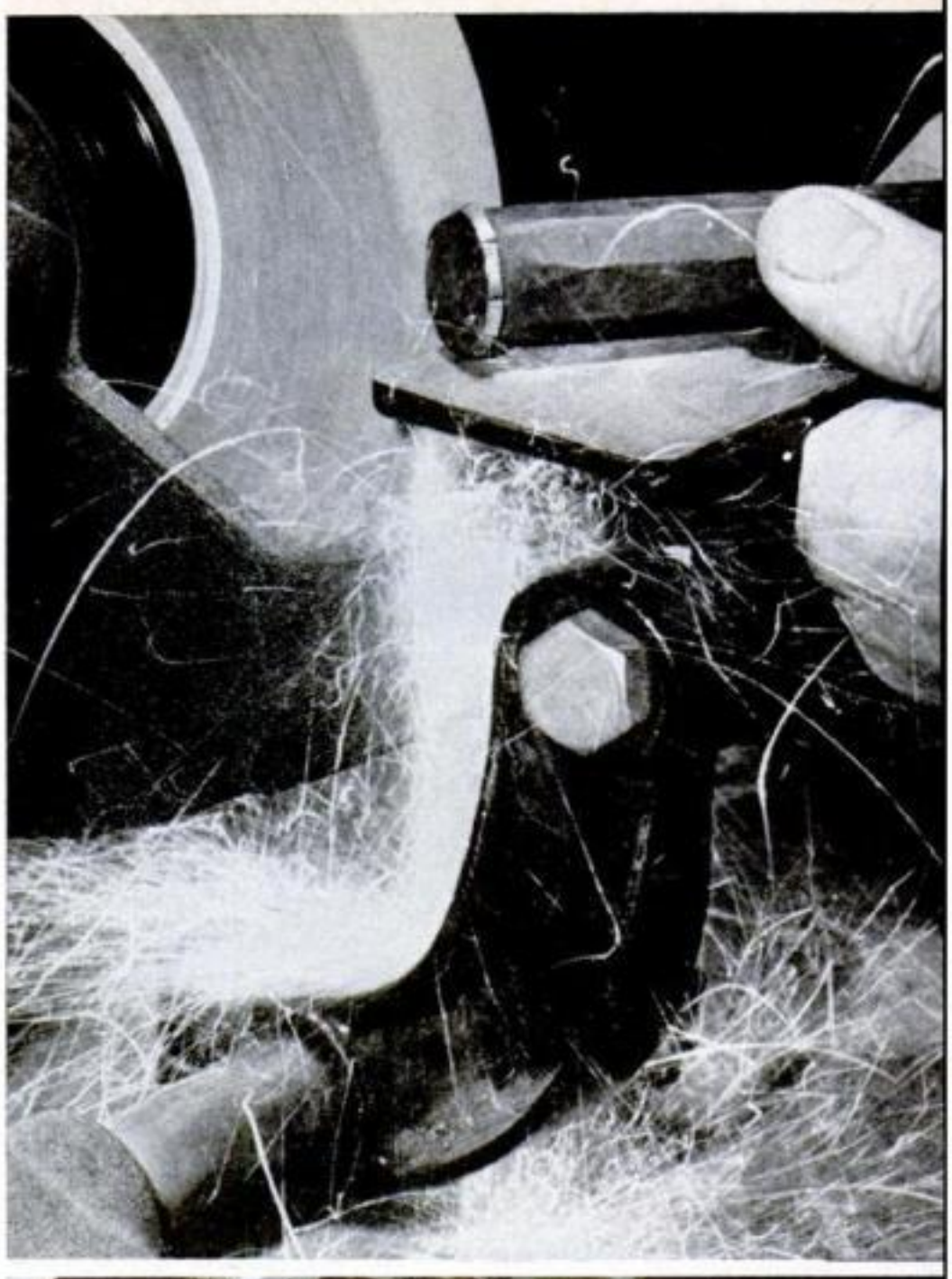
Here's a handy carryall made from a two-gallon oil can. You snip it to the shape shown, fasten in a broomstick handle with screws, and turn over the edges with pliers. The idea works with gallon cans, too.—*Jackson Hand, Westport, Conn.*

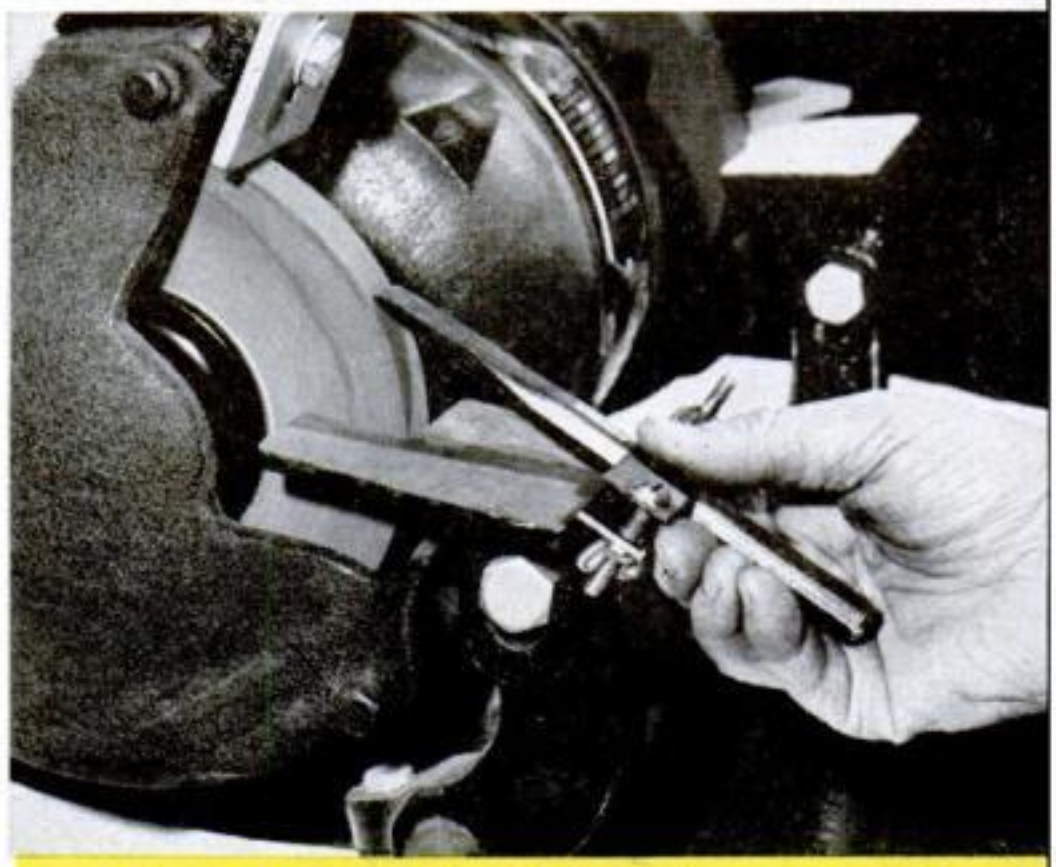
Urheberrechtlich geschütztes Material

PS SHOP TECHNIQUE

How to Sharpen Everything

THE SPECIAL JOBS





A clamp-on stop is handy for sharpening cold chisels, screwdrivers, and similar tools. It's made of two mending plates and a pair of small bolts with wingnuts. The stop insures keeping tool at same angle, even when flipped.

By Harry Walton

EVER think of sharpening cold chisels, screwdrivers, cutting pliers, tin snips, or countersinks? Many shop workers don't. Yet putting new edges on such tools is time well spent.

For cold chisels, the harder the metal to be cut, the blunter the edge should be. For average work, 60 degrees is about right. For soft metals, 40 to 45 degrees may be used.

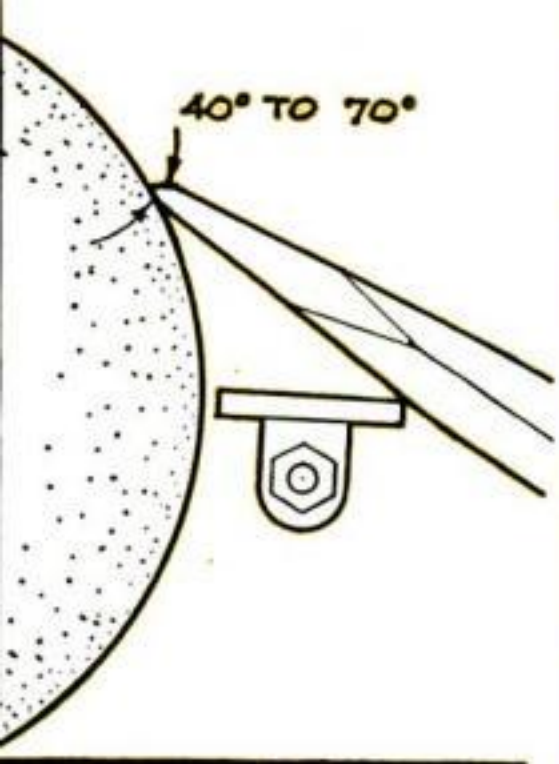
Sight the angle against the wheel and fasten a stop to the chisel to maintain this angle. Flip the tool over to grind the opposite bevel. Dip the chisel in water occasionally to cool it.

Roundnose and diamond-point chisels are ground on the end only: For soft metals, they may be hollow-ground on the face of the wheel, but for heavy duty the edge will stand up better if the end is ground flat on the side of the wheel.

Once chisel heads split or mushroom, the next hammer blow may send dangerous slivers flying. So grind off the deformed metal.

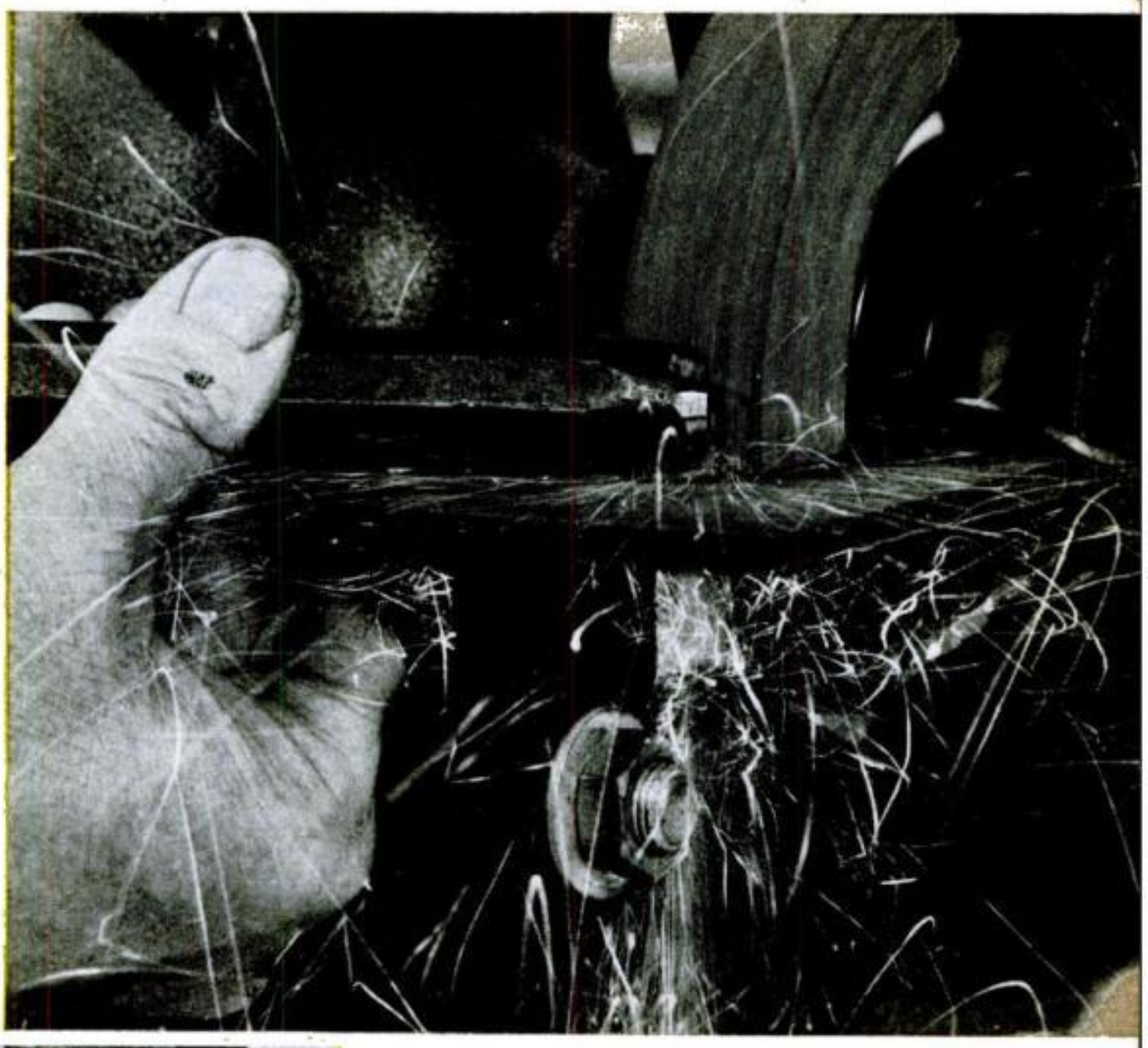
Screwdrivers. Actually, you don't sharpen a screwdriver. But reshaping the blade can make a terrific difference in the way it grips a screw. Seen from its side, a screwdriver tip should have parallel faces. A tapering tip tends to rise up when turned in the screw slots.

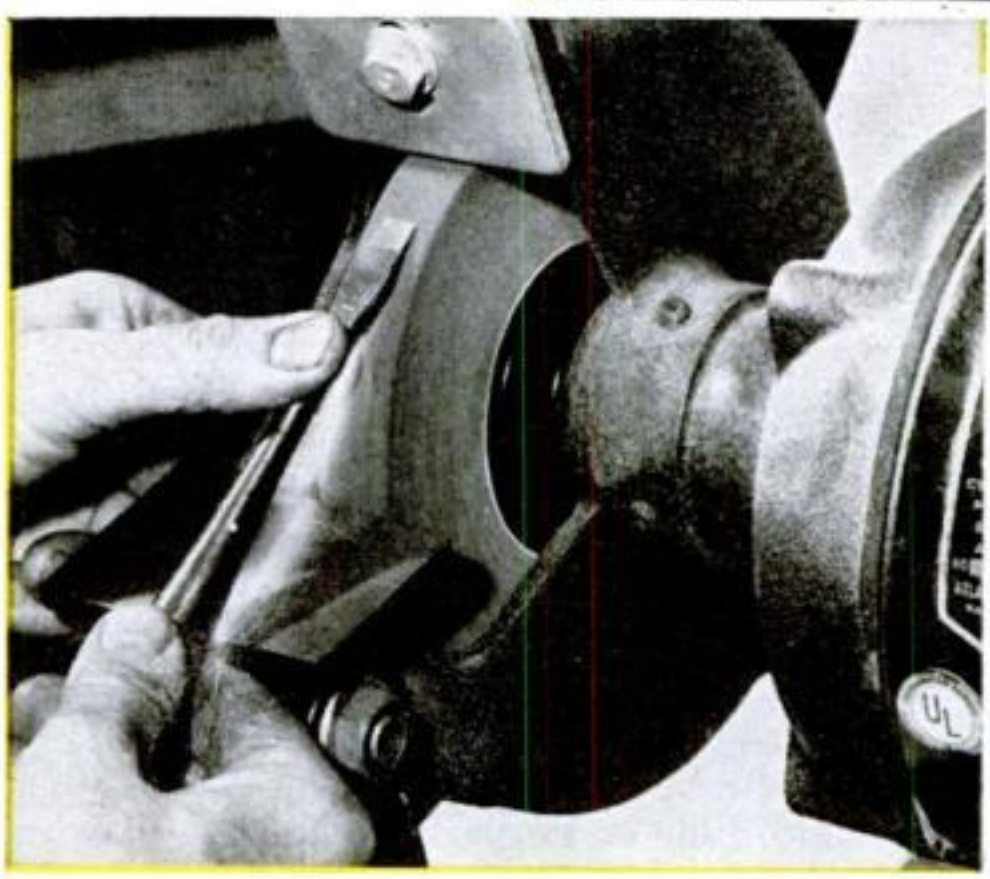
Urheberrechtlich geschütztes Material



COLD CHISELS

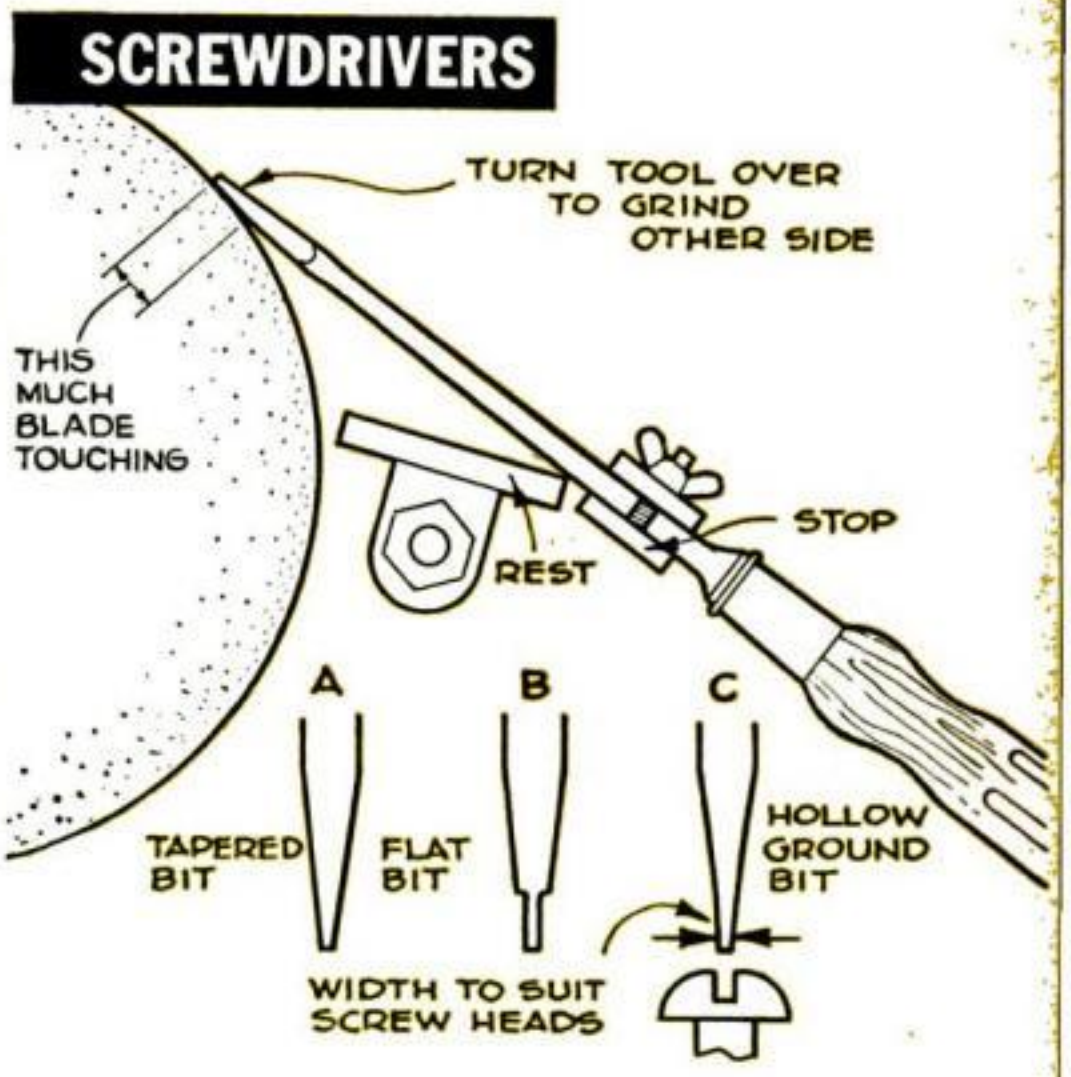
Sparks fly, in the photos at left and right, as the head of a cold chisel is made safe for further use. At left, split and deformed metal is being ground off the battered head of a long-used chisel. At right, a uniform bevel is being ground around the tool head.





Hollow-grind screwdriver bits (C) to give them a new bite in screw slots. Tapered bit (A) tends to slip from slot; a flat grind (B) weakens the bit. In grinding, place bit high on wheel to form slightly concave surface.

SCREWDRIVERS



Grinding flat faces is difficult and weakens the bit. Hollow-grinding on a wheel forms concave faces that are much stronger.

If the tip is nicked, rounded, or out of square, first grind it straight and perfectly square to the shank. Set the grinding rest at center height, and remove no more metal than necessary.

With the wheel stopped, sight against it and the screwdriver to determine the

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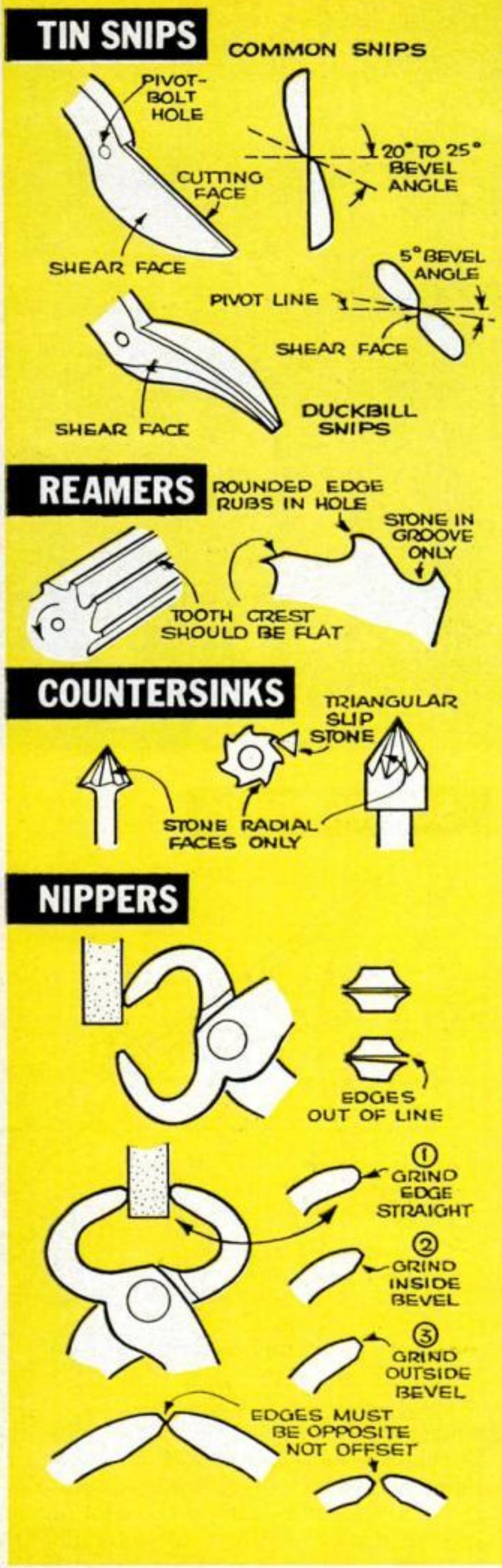

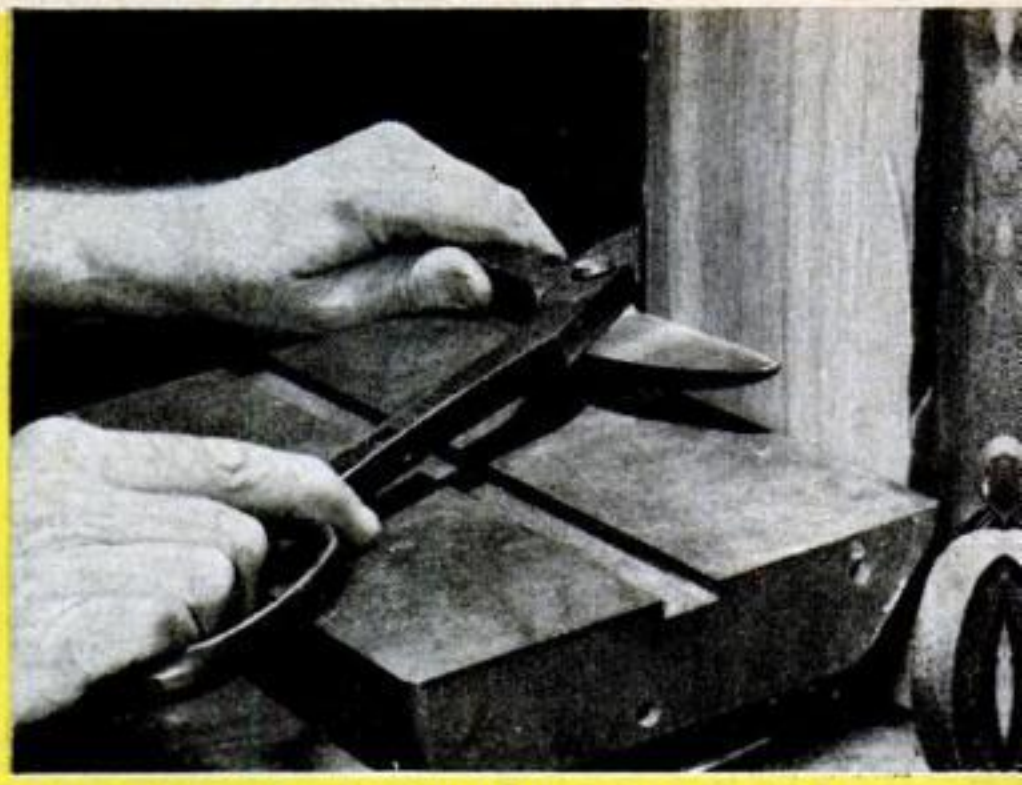

Tin snips can be sharpened on a belt sander without taking the blades apart. First, tilt the sander table to the desired bevel angle and hold the snips down firmly as above, or use a wood block to tilt up the blade. Open the snips as far as possible to keep the other blade away from the belt. When one blade has been sharpened, turn the snips upside down to grind the other one. Finally, whet the shear (inside) face, holding a fine handstone flat on it. This will remove any burrs.

grinding angle. To hold this angle when grinding, clamp a stop to the shank or use your thumb and forefinger. With the other thumb, press the flat of the bit against the wheel.

When a hollow-ground surface the full width of the bit appears, turn the screwdriver over and grind the other face, keeping the stop or fingers at the same place on the shank. The thickness of the tip should suit the screws it is meant to drive.

Tin snips. These can be sharpened on a wheel, on a sanding belt, or with a handstone. Study the bevel carefully; then stone or grind the cutting faces to the original angle. Finally, whet the shear face, holding the stone perfectly flat.

If the inside or shear faces show wear or ridges, take out the rivet or bolt on which the blades pivot. Grind each shear face on the side of a grinding wheel to a single flat surface extending well over the pivot-hole area.

In replacing the pivot bolt, tighten it only enough to bring the shear faces into close contact without binding. Oil these faces and the pivot bolt.

Countersinks. You can sharpen these by handstoning the flat radial faces. Use a small triangular or rectangular slip stone,

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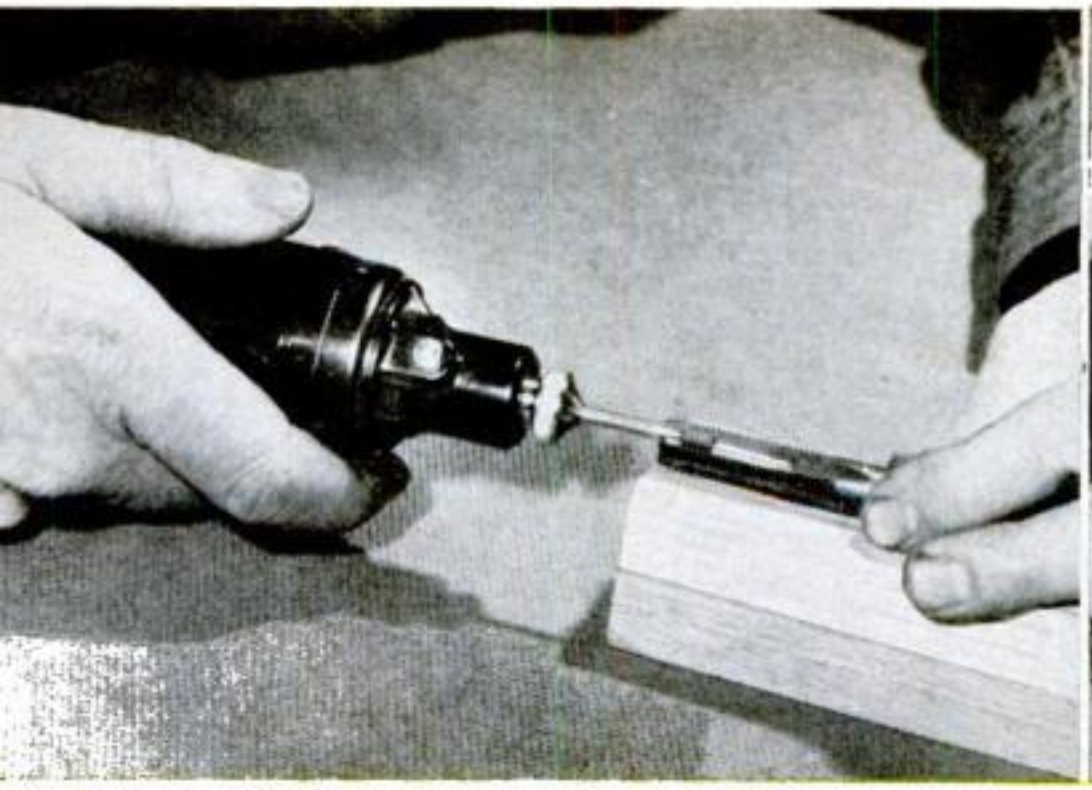
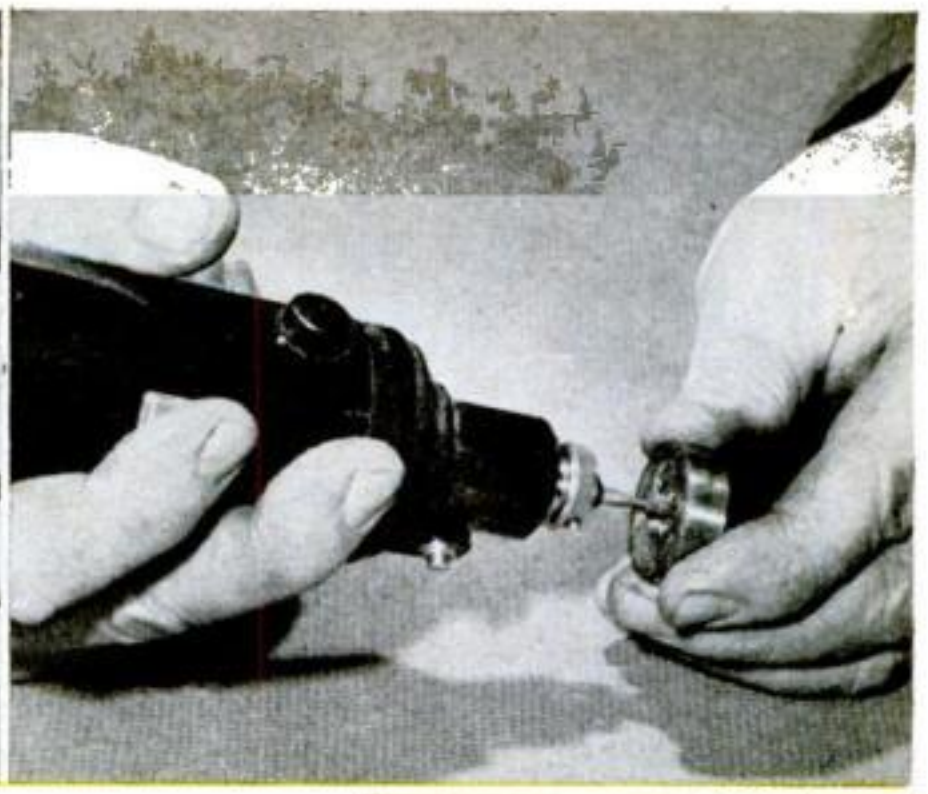
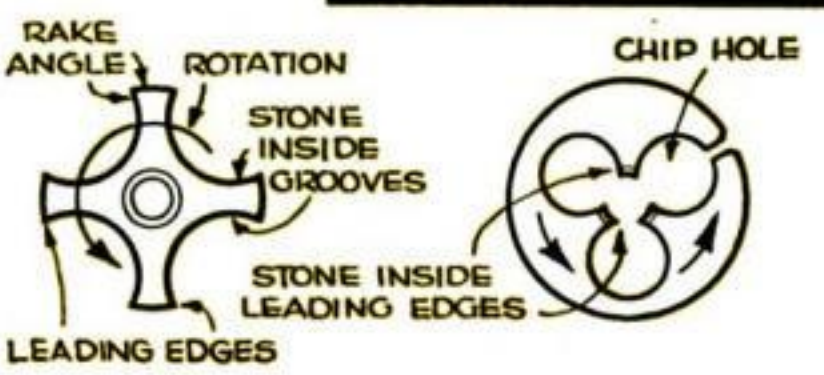




An electric hand grinder, fitted with a small cylindrical stone, can be used to sharpen taps if you work carefully. Grind in the groove along the leading edge of the teeth—the edge that bites in as the tap is turned. For this job, you can also use a hard (Arkansas) stone with a rounded edge. To sharpen dies, grind in the clearance holes, as above at right. Be careful to retain the hook or rake angle between hole and leading edge. Rinse away grinding dust; it would dull the tool.

TAPS AND DIES



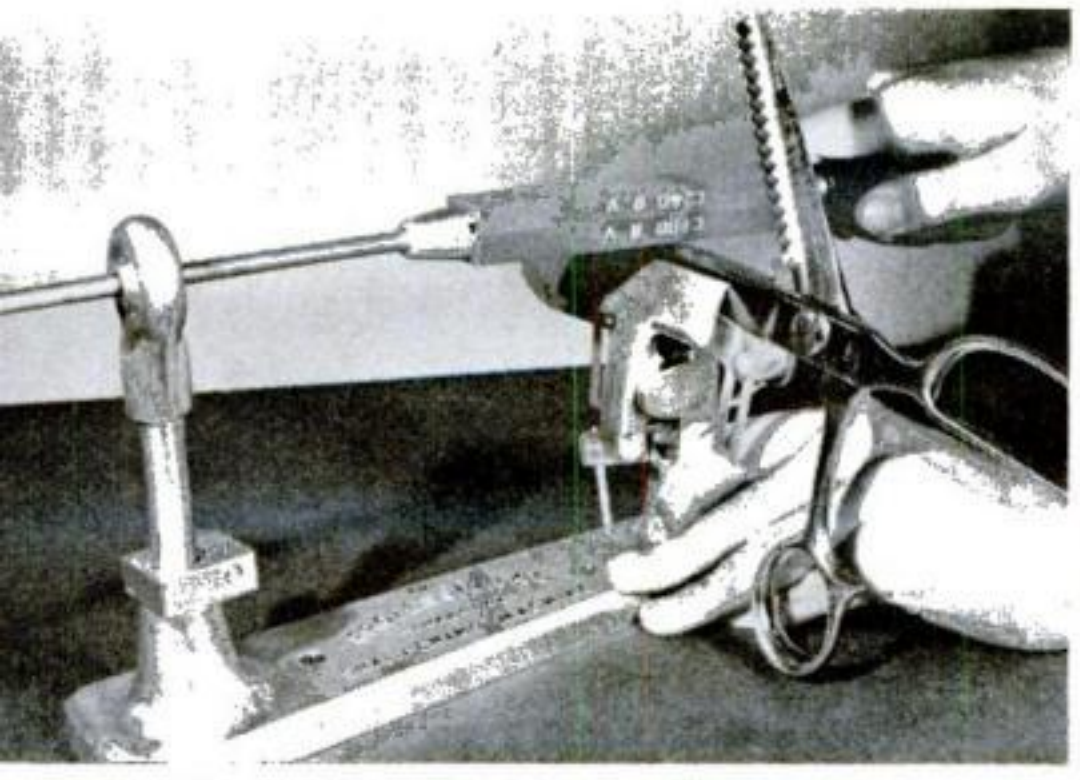
hard enough not to become grooved in use. Keep the stone flat on the faces, taking care not to tilt it.

Better not stone or grind the cutting lips; it's difficult to do right except on a machine setup.

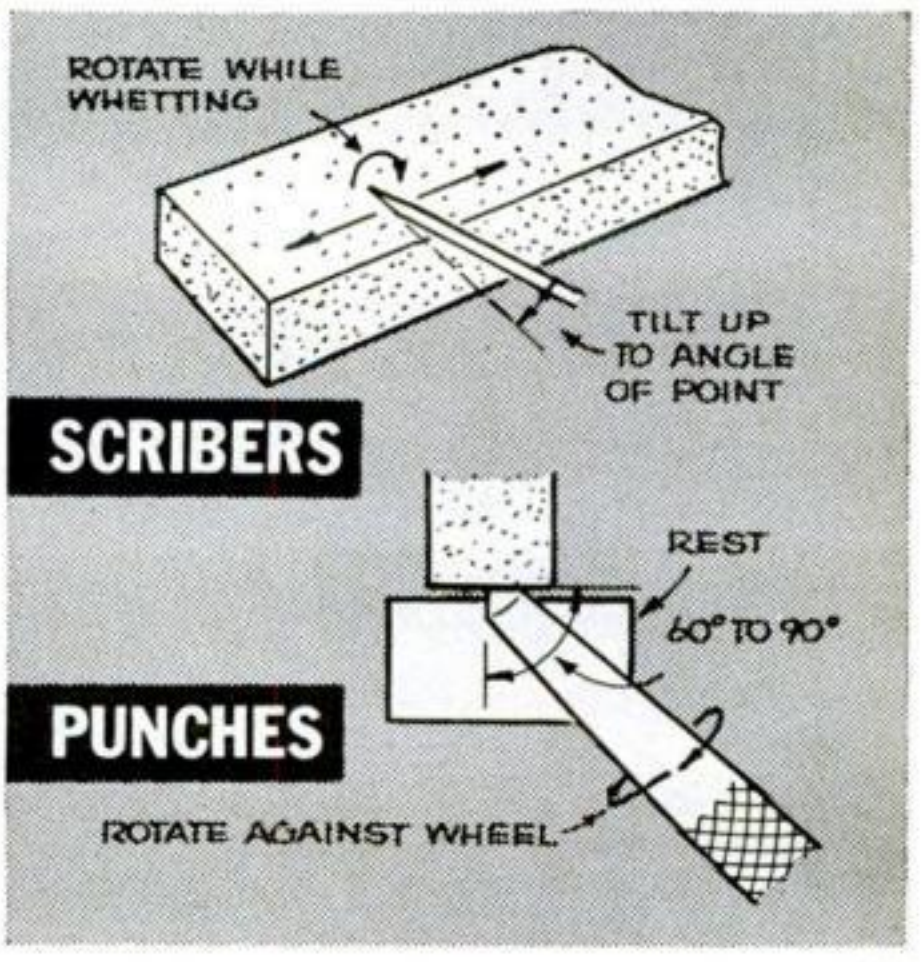
Punches, scribers, and icepicks. A bench stone works fine on these. Turn the tool between the fingers while stroking it across the stone. With a handstone, the tool can be held at an angle against a bench edge, and the stone stroked across it as the point is turned.

A fine-grit wheel may be used if the tool is applied with a light touch. Turn it continuously on the grinding rest so as not to grind flats on the conical surface.

[*Continued on page 185*]



Sharpening of scissors and pinking shears is easy if you have a machine made by Blackhawk Supply, Sheldahl, Iowa. Price: $16. Pinking shears are whetted as shown.



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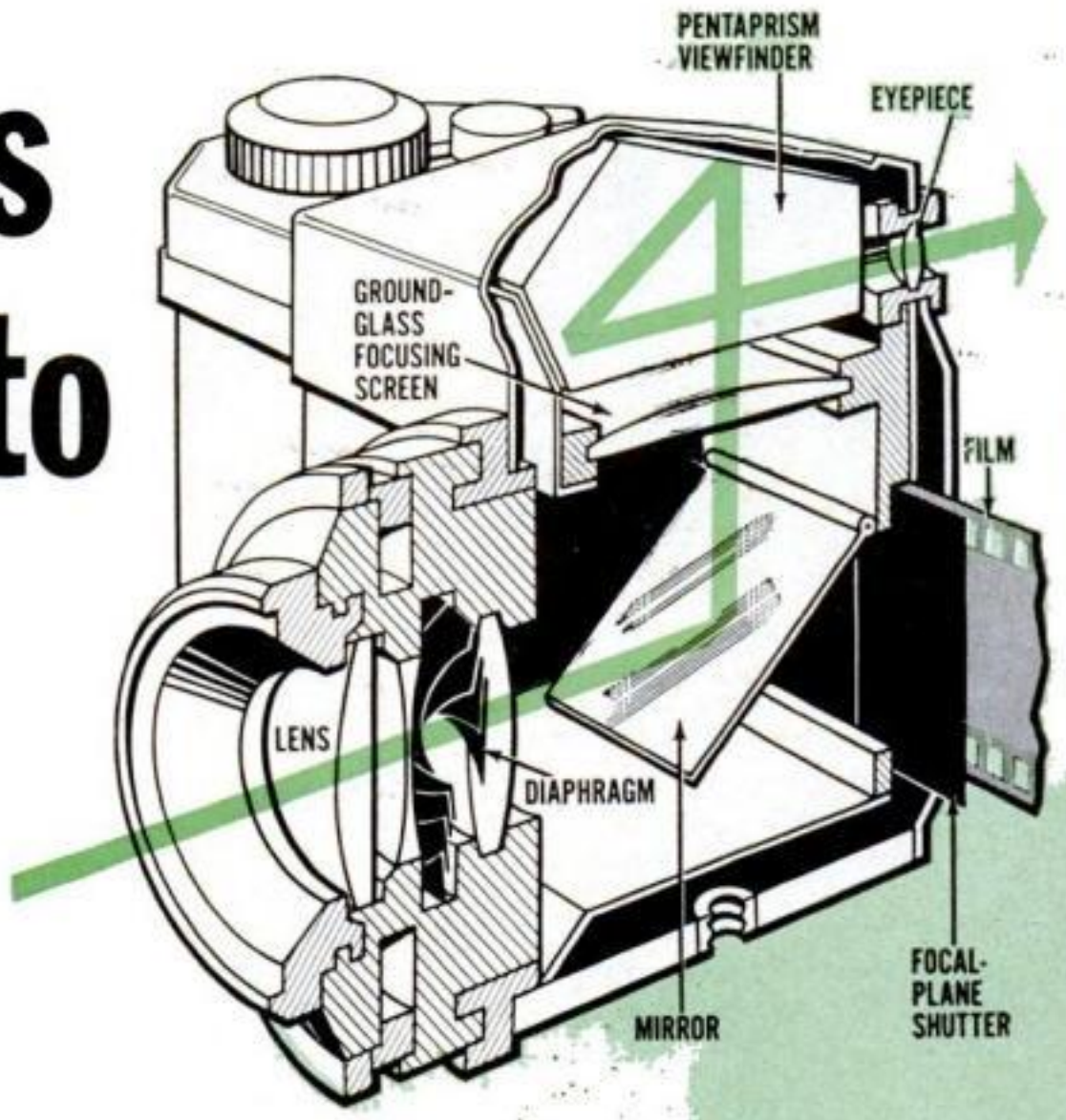
PS PHOTOGRAPHY

Look What's Happening to SLRs

The single-lens reflex is now the most-wanted camera. Here's a guide through the maze of new features



A typical single-lens reflex inside and out

What to look for: Nikon F exhibits all of the desirable features—focal-plane shutter, pentaprism finder, instant-return mirror, automatic diaphragm, complete interchangeability of lenses. Controls are well arranged for ease and speed of operation. All markings are easy to read. Body shape and size fit most hands comfortably.

By Paul Wahl

THE irresistible attraction of the single-lens reflex camera is that you see exactly the picture you're going to get—before you snap the shutter. Most people are sold on the idea the first time they peer into the viewfinder.

But the manufacturers have had a lot of drawbacks to overcome to make the basic design into a workable and versatile camera. Twenty-five years ago there was only one 35mm SLR on the market, the Exakta, and only a few farsighted professionals gave it much notice. Now, there are more than 60 models. New models and features are coming out

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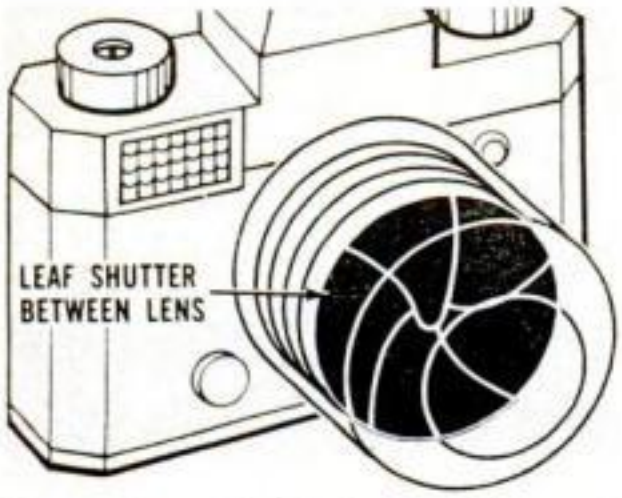
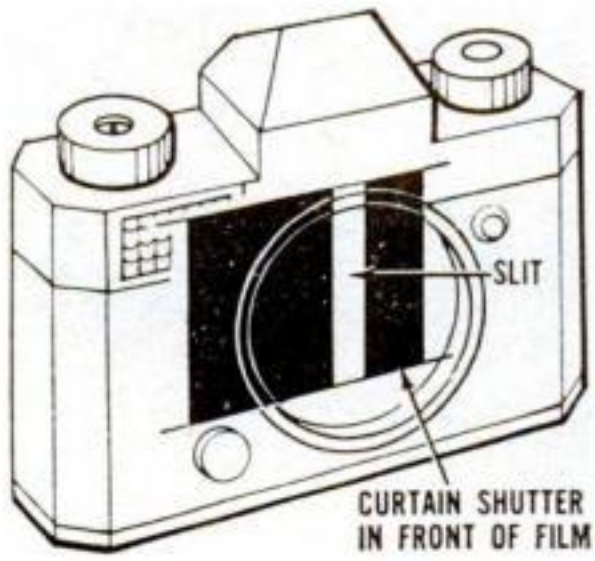
Leaf shutter or focal-plane shutter?



Between-lens leaf shutter does not permit lens interchangeability, but can give automatic exposure and full flash synch.

Behind-lens leaf shutter permits limited lens interchangeability, is adaptable to automatic exposure control and flash synch.



Focal-plane shutter gives full lens interchangeability. Disadvantage: flash synch limited to shutter speeds below 1/60.

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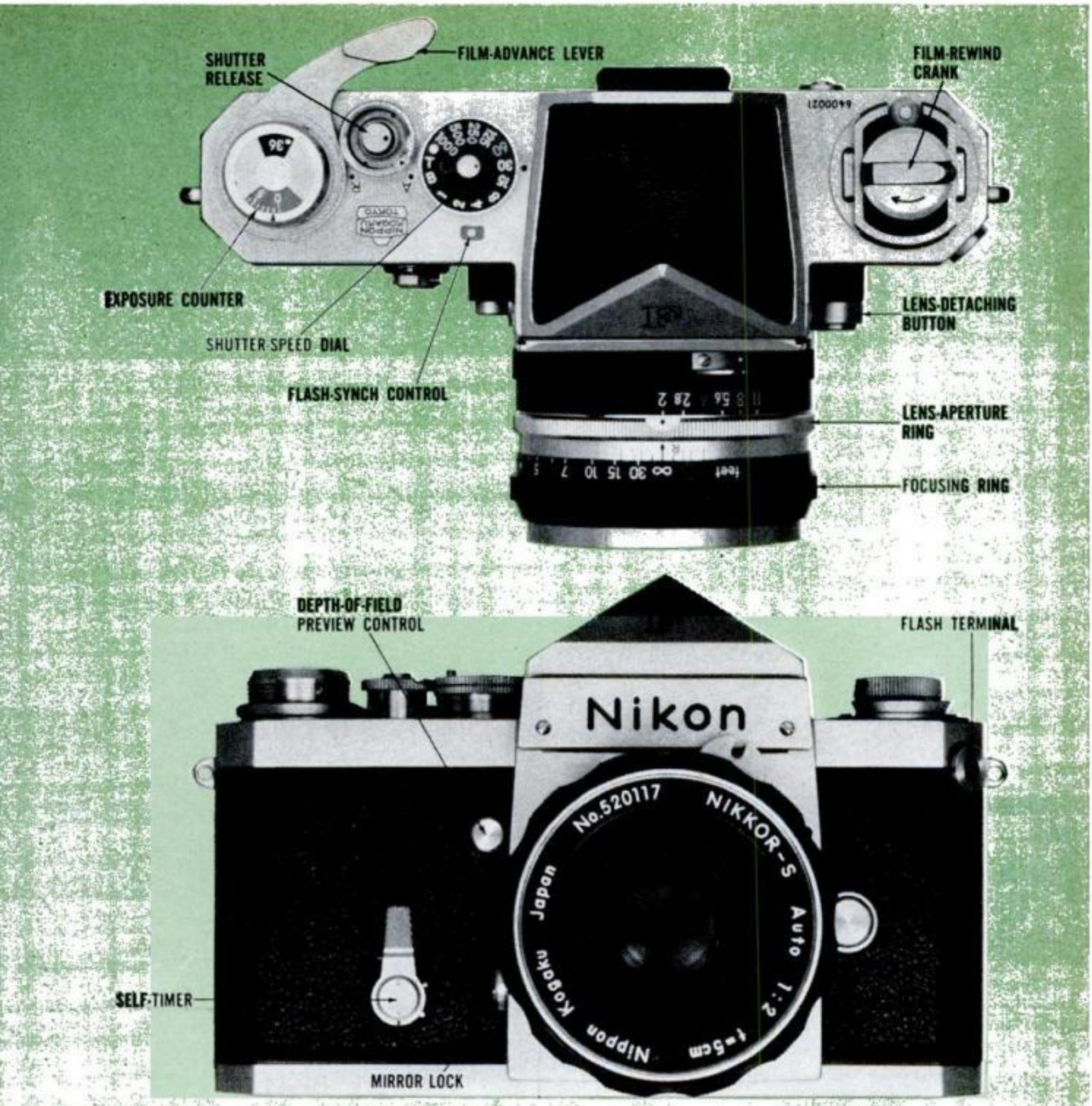
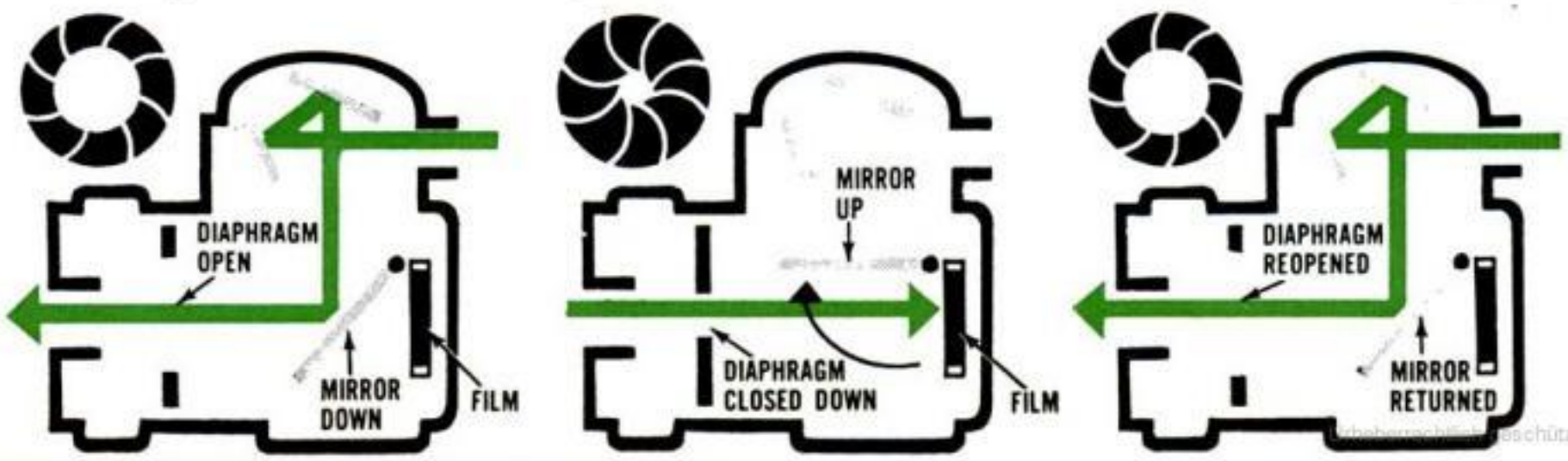


Automatic diaphragm and instant-return mirror

1 **For focusing** and composing, the instant-return mirror is in its "down" position and the automatic diaphragm is wide open to give you the brightest possible image when you look at the viewing screen.

2 **Press the shutter release** and the mirror flips up out of the way, the diaphragm automatically closes to the preselected taking aperture, the shutter opens (to take the picture) and closes.

3 **When the exposure is completed,** the mirror flips down and the diaphragm reopens to maximum aperture instantly. Within a few milliseconds, the camera has been readied automatically for the next picture.



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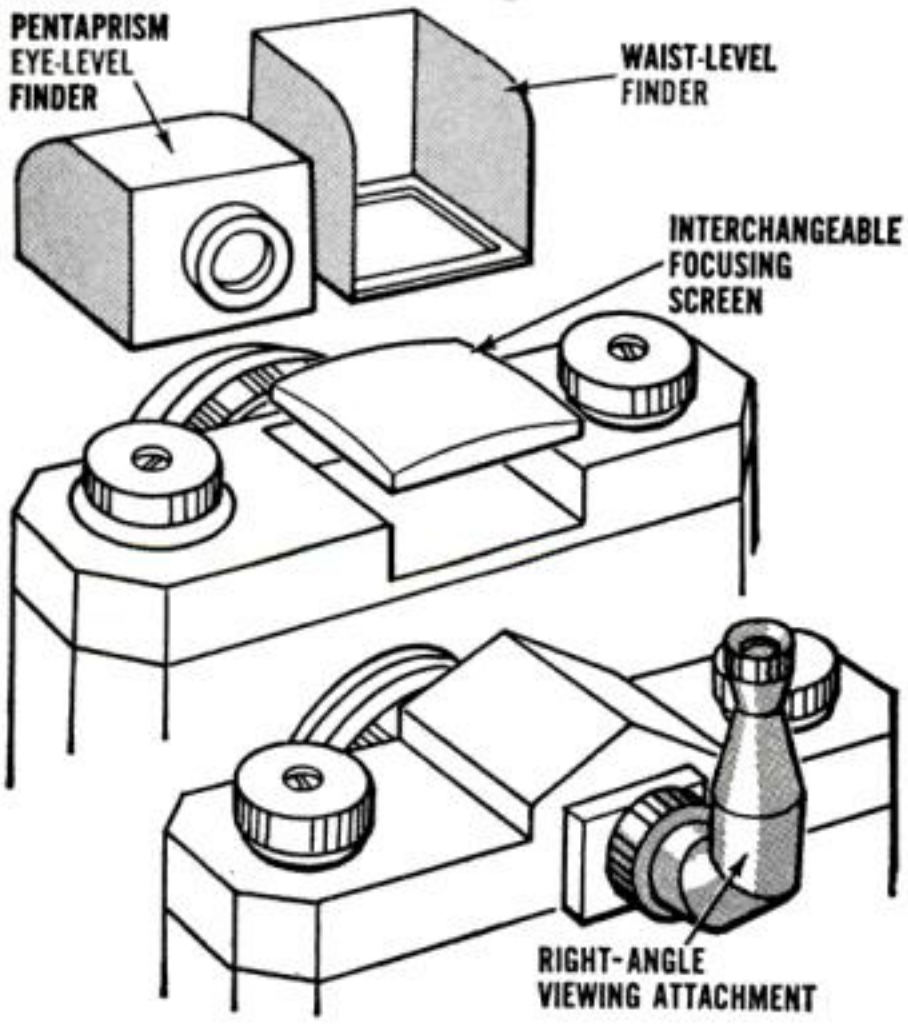
Finders: interchangeable or fixed



Detachable viewfinder permits the interchange of focusing screens as well as choice of eye-level or waist-level finders. A fixed pentaprism finder is less vulnerable and more likely to retain accuracy of alignment. A right-angle attachment permits lower viewing point.

Focusing screens

Split-image rangefinder has two wedge segments in the center of the screen that split the image laterally. When the two halves of the image are misaligned, the lens is out of focus.

Microprism rangefinder has a central spot made up of many tiny pyramids. These break up an out-of-focus image into shimmering ripples. An in-focus image looks solid and sharp.

so fast it's almost impossible to keep up with them. Prices range from under $100 to over $500. The costlier ones may have features you will rarely need. Less than $200 will buy a top-quality camera with all the essentials. To choose the best one for your needs and pocketbook, you should analyze the features. Here's how to do it:

Shutters. First, you must choose between the focal-plane and the leaf shutter.

More than two-thirds of the current models have focal-plane shutters. Out of the way in the back of the camera body, this shutter does not interfere with the lens, and thus permits interchangeability of a wide choice of lenses. More, you're not limited to the lenses offered by the camera maker; the camera accepts many lenses of other manufacture either directly or by means of an adapter.

The only real disadvantage of the focal-plane shutter is in flash synchronization. You can use long-peak FP flashbulbs at all speeds, but other bulbs and electronic flash require setting at 1/60 second or slower with most focal-plane shutters. In practice, this isn't a serious shortcoming.

Leaf shutters provide for synch of all kinds of flash at all shutter speeds. All leaf-shutter 35mm SLRs have some degree of exposure-control automation; several are fully automatic, a feature not currently shared by any focal-plane-shutter model.

Between-lens leaf shutters do not offer lens interchangeability. Cameras with such shutters generally provide limited wide-angle and telephoto effects by means of converters added to the normal lens or interchangeable front-lens components.

Behind-lens leaf shutters permit full lens interchangeability, but the position of the shutter close to the rear lens element complicates and restricts lens design. Accordingly, only a relatively few lenses are available, focal-length range is 28mm at most, lens choice is confined to those offered by the camera maker, and adaptation of other lenses ordinarily is not feasible.

Automatic diaphragm control. Most current 35mm SLR cameras have this feature. The lens, fully open for focusing and composing, automatically stops down to the preselected taking aperture when you press the shutter release. It reopens automatically upon completion of the exposure. In leaf-shutter models without instant mirror return, the "automatic" diaphragm reopens with film advance.

Automatic diaphragm control in focal-plane-shutter SLRs may be coupled internally or externally. Few use the latter system. External coupling is equally effective, but release may require greater pressure than with internal coupling.

Any automatic diaphragm-control system

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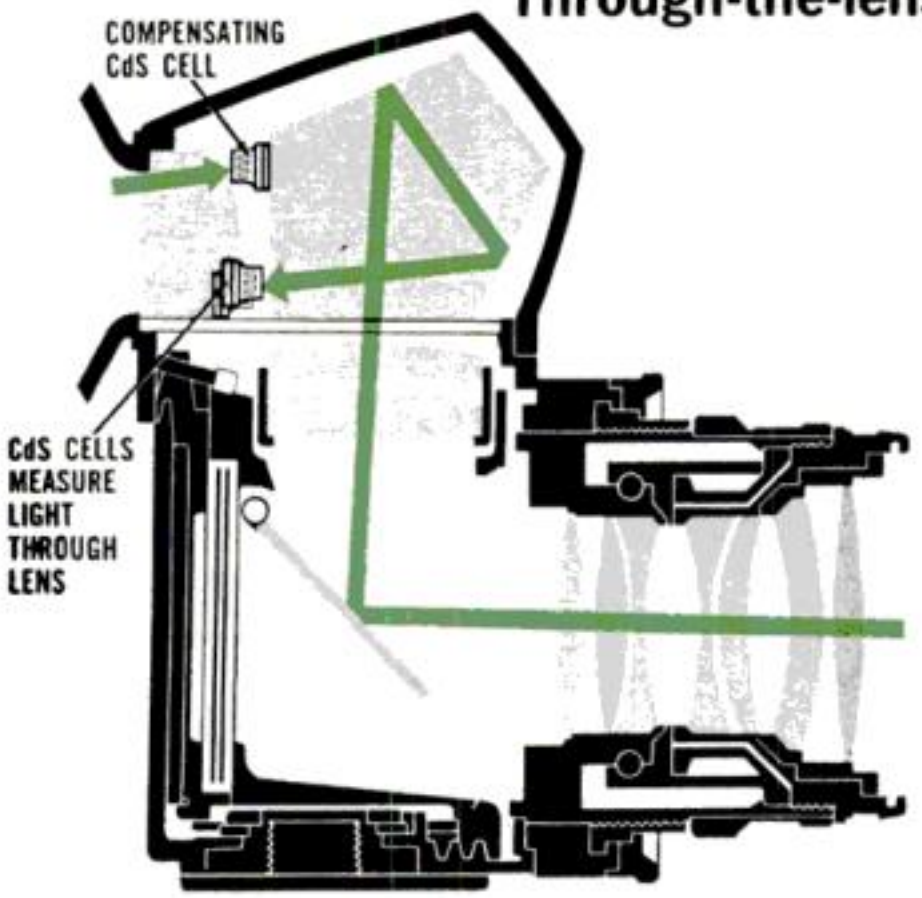
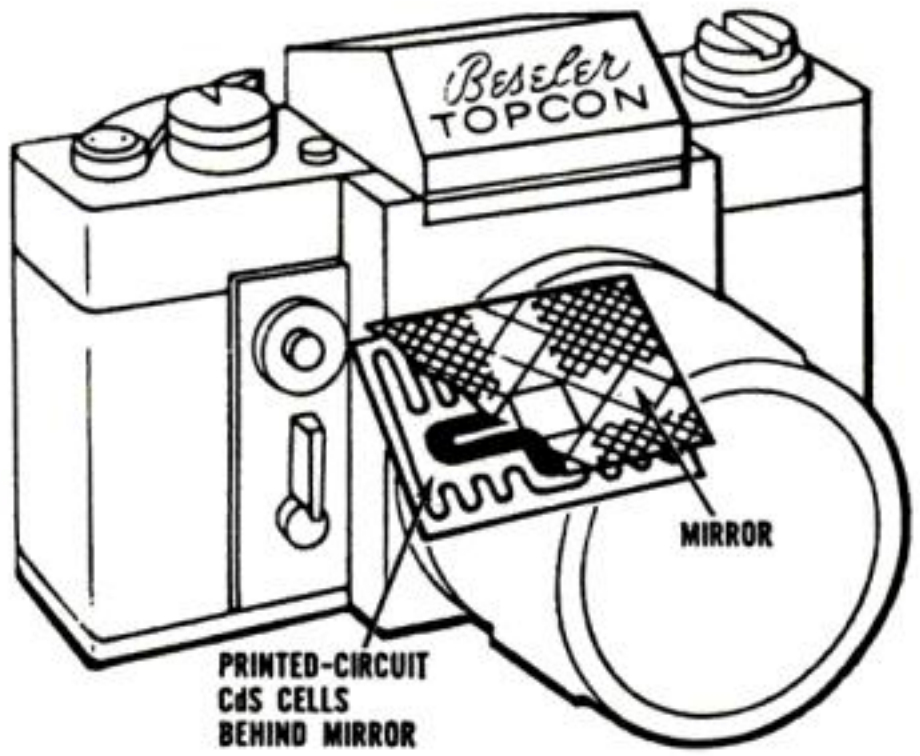
Through-the-lens light metering



Behind-the-lens meter of Alpa 9d is optically coupled and electronically compensated. Two CdS cells, behind the prism but outside the viewing path, measure light through the lens; light entering through the eyepiece is metered by a third CdS cell and subtracted. Center the needle, visible on the focusing screen, and you get correct lens opening for preset shutter speed, or correct shutter speed for preset lens opening.



CdS cell on back of mirror is featured by Beseler Topcon Super D. A pattern of .05mm-wide slits in the mirror surface passes seven percent of the light entering through the lens to the meter cell. The electrical system of the meter is mechanically coupled to the camera controls by means of chains and pulleys. Semi-automatic exposure control is effected by an easy-to-work match-needle system.

should let you stop down to inspect depth of field at the taking aperture.

Although an automatic-diaphragm lens costs more, it is a valuable feature. With the less-expensive preset lenses, you have to open and stop down the diaphragm manually, and there is always the danger of forgetting to reset before making the exposure.

When you press the shutter release, the mirror flies up and the focusing-screen image blacks out. Instant mirror return reduces this blackout to a mere flicker—the mirror automatically flips down after the exposure.

Some cameras still lack this feature. Unless you shoot mostly static subjects, consider instant mirror return a must.

Finders. The eye-level pentaprism finder is standard on all modern 35mm single-lens reflexes. It may be either fixed or detachable to permit interchange with a waist-level finder and the changing of focusing screens.

While you'll use the eye-level finder most of the time, occasionally the look-down-into-it viewpoint of the waist-level unit may be desirable, as in tripod work, copying, macrophotography, photomicrography, etc. A right-angle (elbow) attachment gives similar results with a fixed pentaprism.

The nondetachable pentaprism finder is better protected against injury and does not permit entry of dust. Otherwise, the choice between detachable and nondetachable finders depends on the importance to you of being able to change focusing screens.

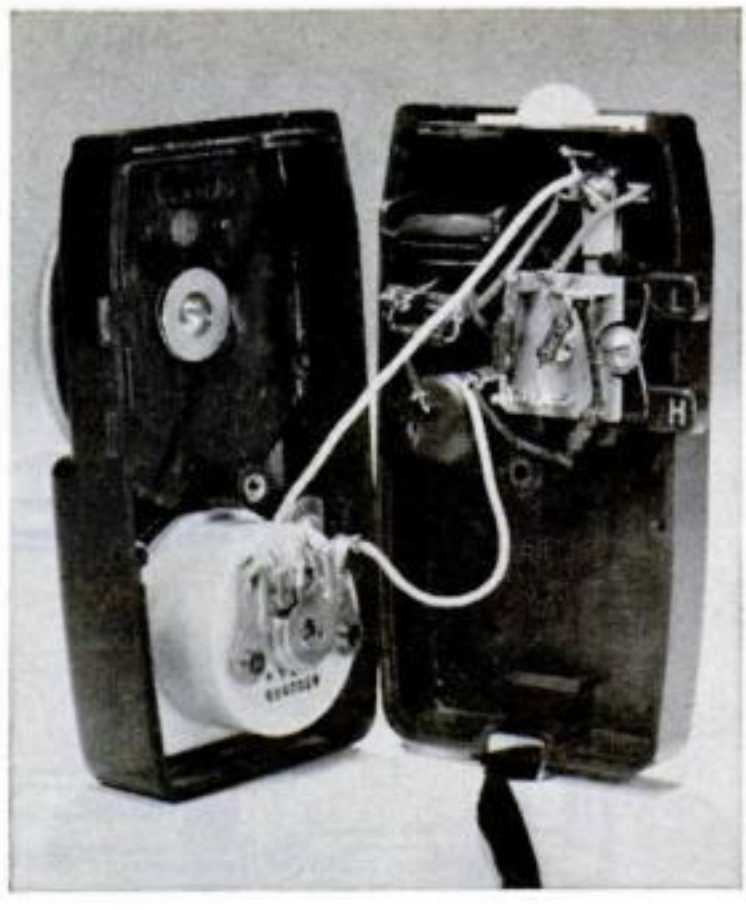
Focusing screens. Common to most of today's 35mm reflexes is the split-image rangefinder, usually surrounded by a fine ground-glass collar and centered in a full-focusing screen.

Accurate focusing with a split-image rangefinder requires a well-defined straight line in the subject—obviously not always present. At small apertures, with long-focus lenses, and in poor light, one half of the rangefinder blacks out, rendering the device useless. Despite these shortcomings, most users find the split-image rangefinder best for general use.

A more recent development, the central focusing grid or microprism, is found in several cameras. When the lens is out of focus, the grid image breaks up into ripples. Some people have trouble in finding the point of sharp focus with this device; to others, it is more effective than the split-image rangefinder.

Many photographers, especially experi-

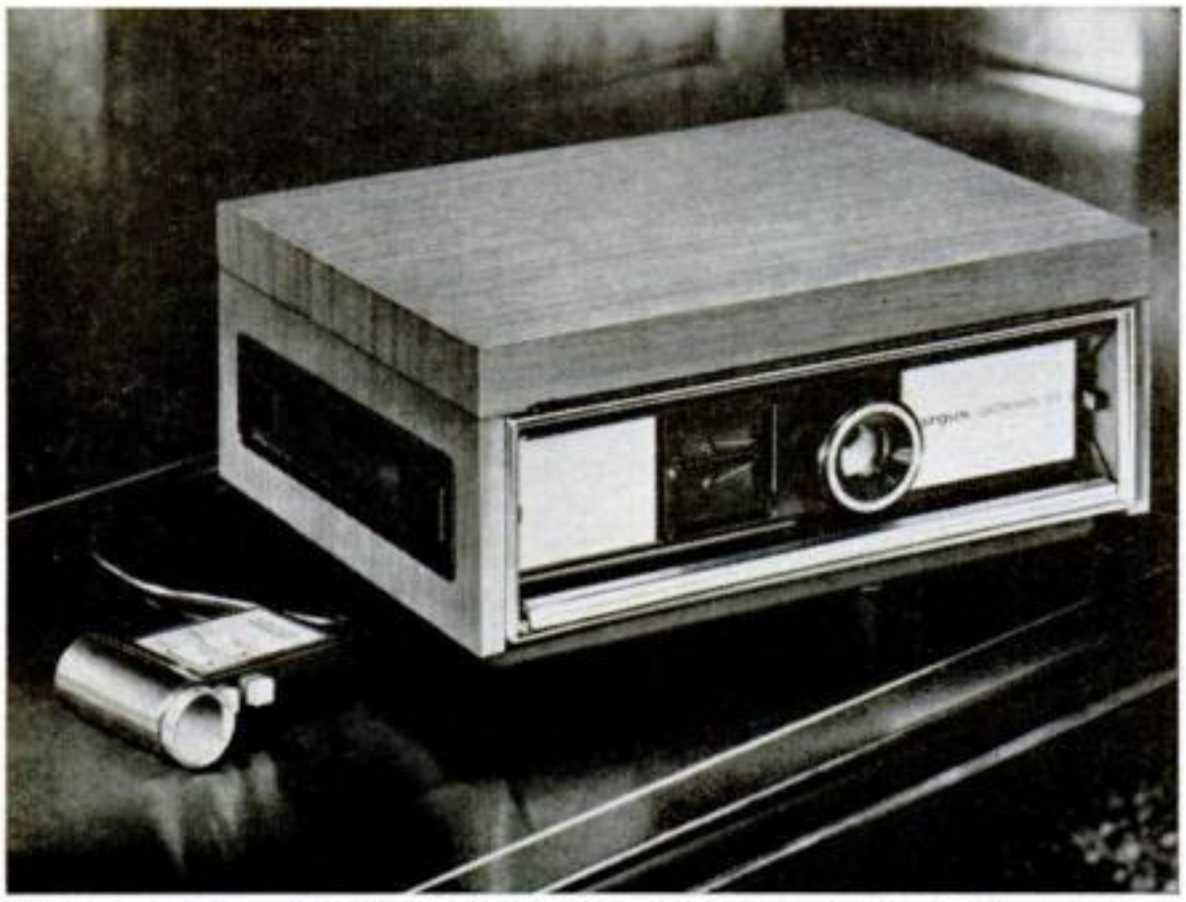
[*Continued on page 204*]



Supersensitive Exposure Meter You Can Build from a Kit

You can measure the exposure for a subject lighted only by a match or moonlight with this new, kit-built exposure meter. It uses a cadmium sulfide cell and has a high and low range with pushbutton selection. In side-by-side comparison with a factory-made CdS meter, which cost more than three times as much, the Knight-Kit meter gave identical readings throughout the range from full sunlight to candlelight.

The calculator dial is well designed and has color-coded scales for both movie and still cameras. Following the step-by-step instructions, the kit can be easily assembled in a half-hour. Price: $15.88. Allied Radio, 100 N. Western Ave., Chicago 80.



Fully automatic 35mm slide projector is designed to look like a piece of furniture

The new Argus 573 "Decor" slide projector is fully automatic, has a self-timer that changes slides at preselected intervals of 4, 8, 16, or 32 seconds, and is finished with walnut veneer. There's an electric remote control for forward, reverse, and focusing. Price: Under $150. Argus, Inc., 5950 W. Touhy Ave., Chicago.

8mm projector has built-in viewing screen

You get just about every feature you can imagine in the new Duo-Vista 8mm projector. You can view your movies on the built-in screen or project them in the usual way. It also has variable-speed forward and reverse. Price: About $175. DeJur Amsco, Northern Blvd. at 45 St., L.I. City, N.Y.

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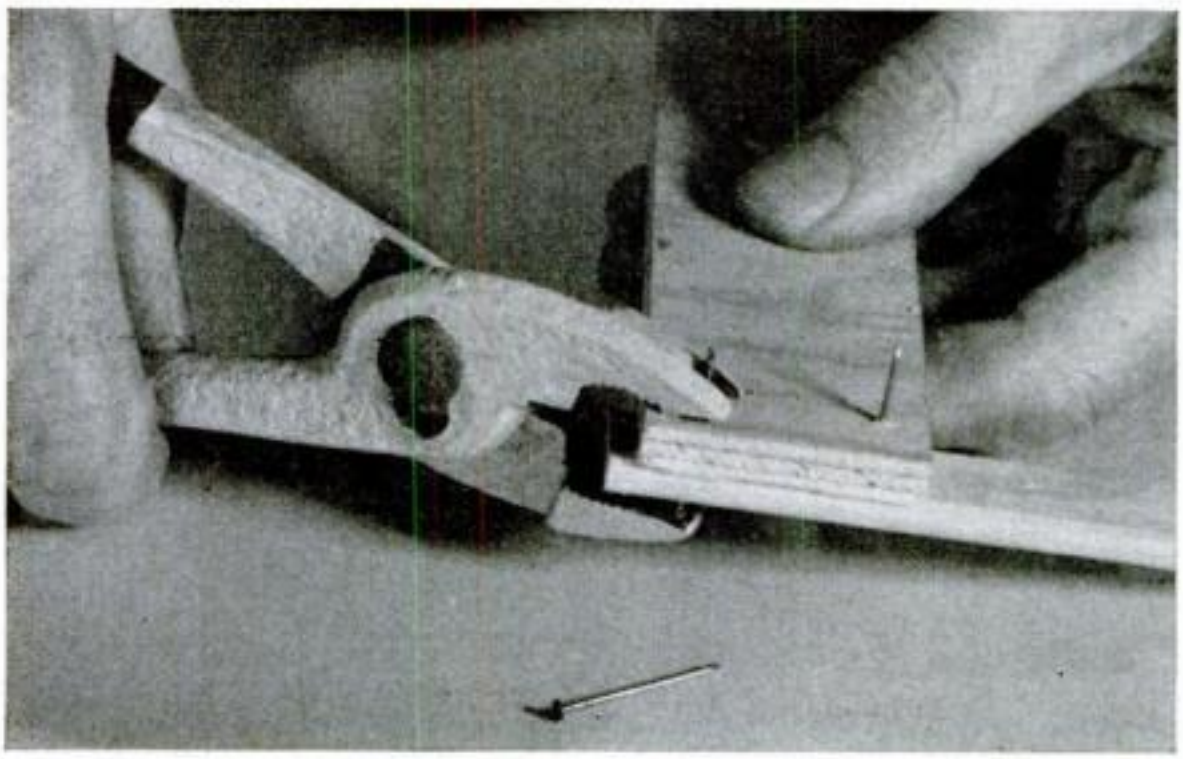
Short Cuts and Tips FROM PS READERS

Lantern hanger hooks to your car

Need roadside light when there are no trees around on which to hang your lantern? Here's a handy hanger that you can carry along in your car for just those times. The hanger hooks into the car's rain gutter and rests against the side. Make the upright about 20″ long, the arm 8″ to 10″. A notch in the arm keeps the lantern from slipping off. A rubber foot, or toilet-seat bumper, on the lower end of the hanger protects the side of the car from scratches.—*Steven Hoyt, Redlands, Calif.*



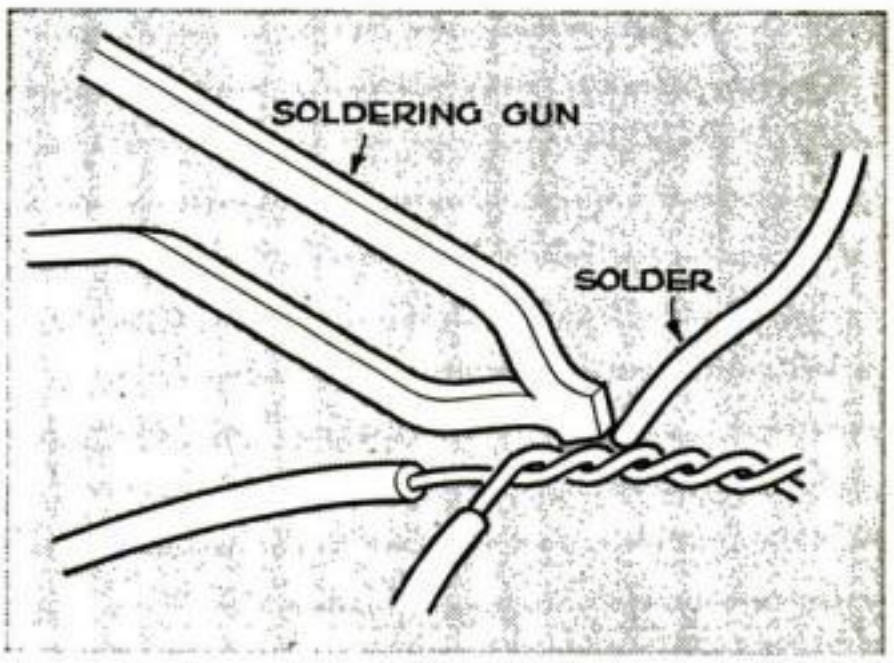
Slotted pliers become a miniature pulling tool

An old pair of pliers with a slot ground in one jaw makes a useful shop tool. The slot slips over nails, pins, and small shafts so that the other jaw can apply a direct push.

This is handy for pulling tiny gears or wheels off shafts, driving or removing nails and pins, or seating rivets in tight places.—*Walter E. Burton, Akron, Ohio.*

Using solder to speed soldering heat

When you're soldering a twist-type wire splice with a gun, there's often so little contact area between the tip of the gun and the twists that the wire won't come up to soldering heat properly. You can shorten the heating time by melting a bit of solder directly against the tip and allowing it to run down into the splice. The solder fills the gaps between the twists and increases the contact area so that heat is carried through the entire splice more quickly.—*Bob Gilmore, Sonoma, Calif.*



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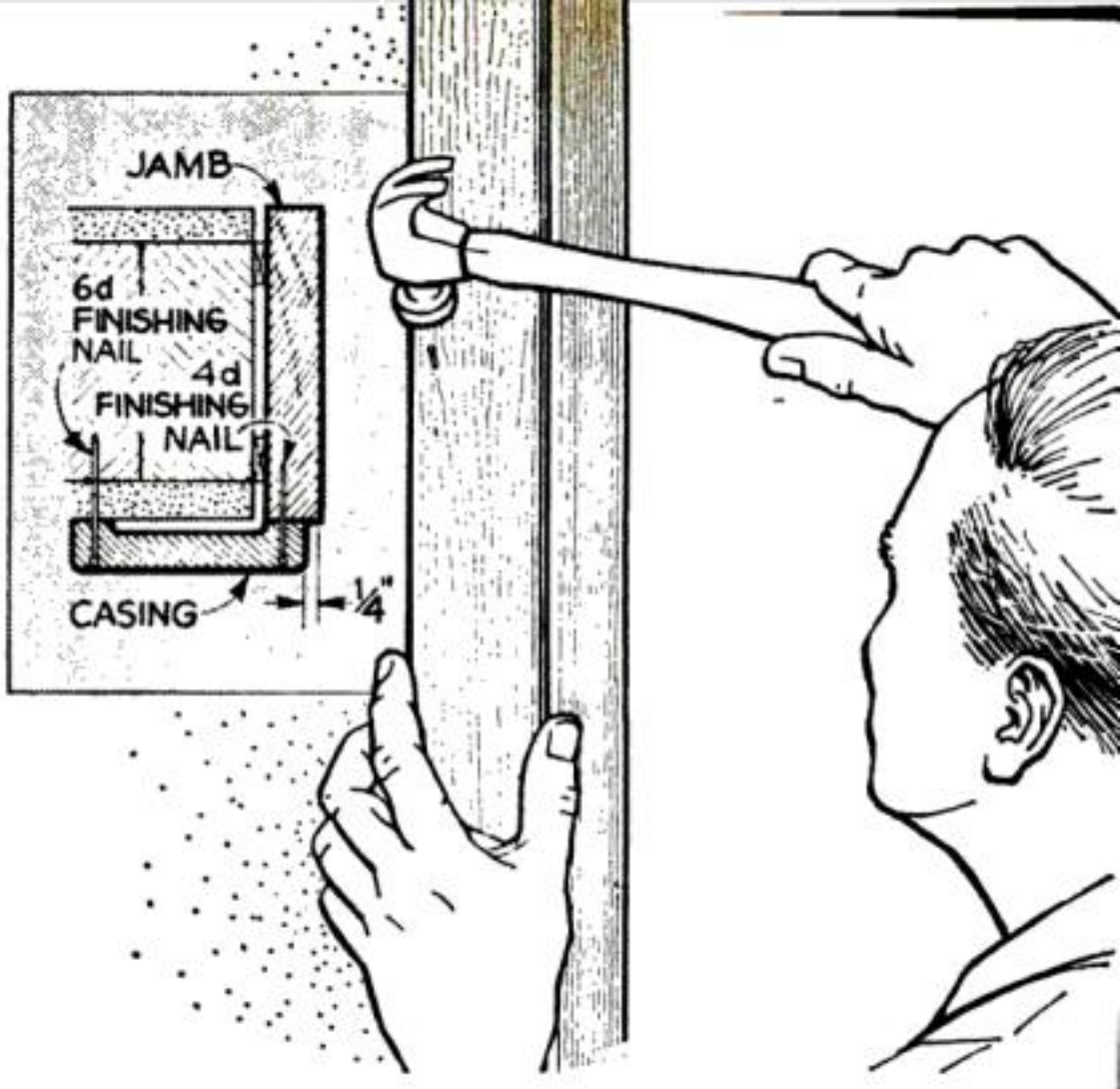
PS HOME IMPROVEMENT

Smart Trim Tricks for Home Remodeling Jobs

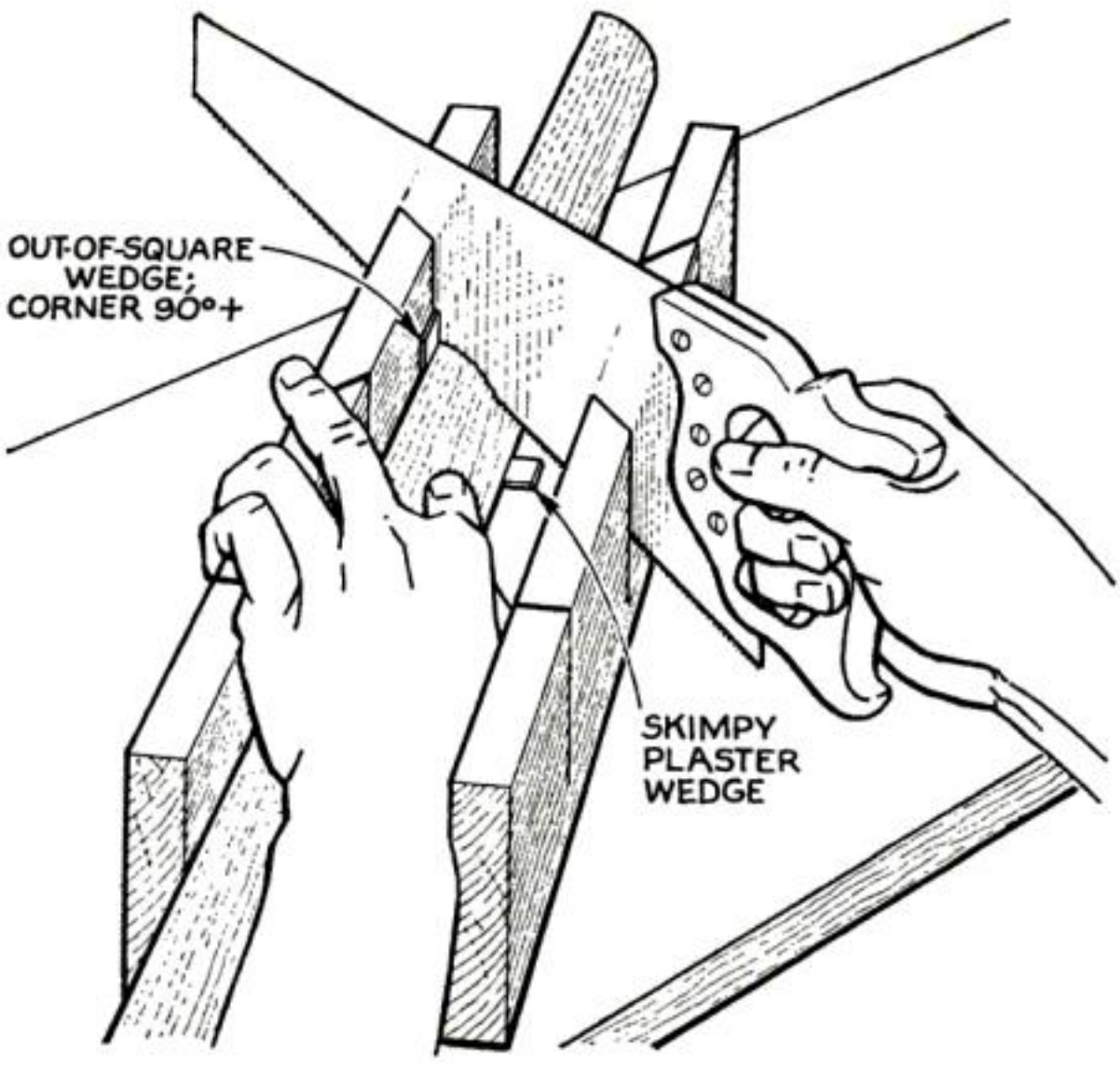
Expert carpenters use these ideas on door casings, baseboards, and moldings. You can, too

By Edwin M. Love



The right way to nail a door casing

It's customary to set the thin edge of the casing ¼" in from the jamb edge, following a pencil line. The natural impulse is to nail the casing to the jamb. But it's better to hold it to the line and nail the back edge into the framing first, usually with a six-penny finishing nail. Then drive a four-penny finishing nail into the jamb. Set the back nail first, using the jamb nail to spring the trim to a tight fit with the jamb. Nailing the back edge first puts the strain on the framing if the casing must be pulled straight. Don't stagger the nails; a back one may pull the casing away from the jamb between the front nails.



What if a true miter won't fit?

Before cutting a casing, see if the opening is square. If it isn't, or if the plaster projects in front of the jamb, a true miter won't make a tight joint.

You can produce such conditions in the miter box (sketch, left). If the opening is more than 90 degrees, put a thin wedge behind the casing *near* the cut; *away* from the cut if it's less. If the plaster projects, put a thin wedge under the thick edge of the casing; if the plaster is skimpy, put it under the opposite edge. When you've made these adjustments, the miter probably will fit perfectly. The most it should need is a touch with a plane.

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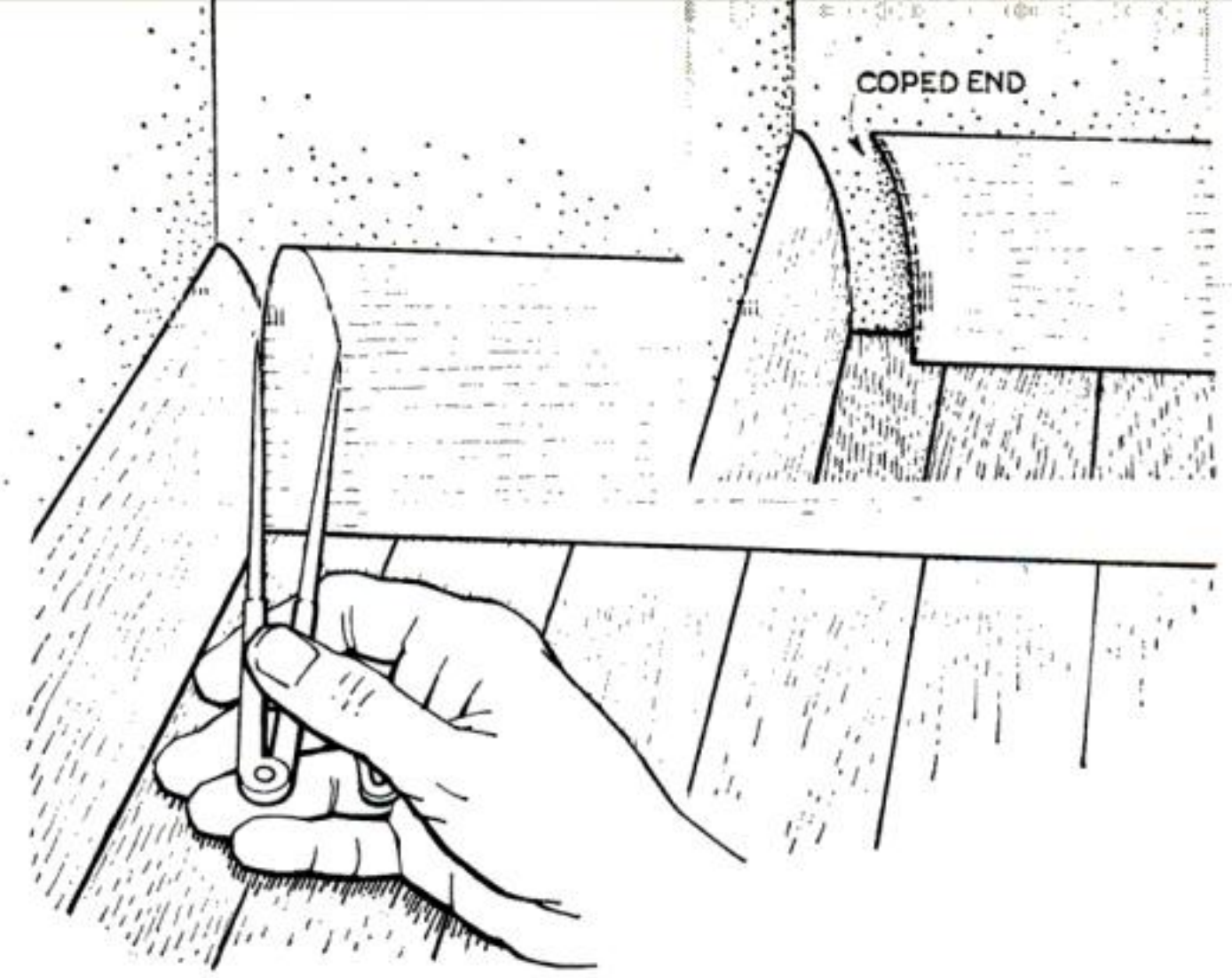
What to do about the thick and thin

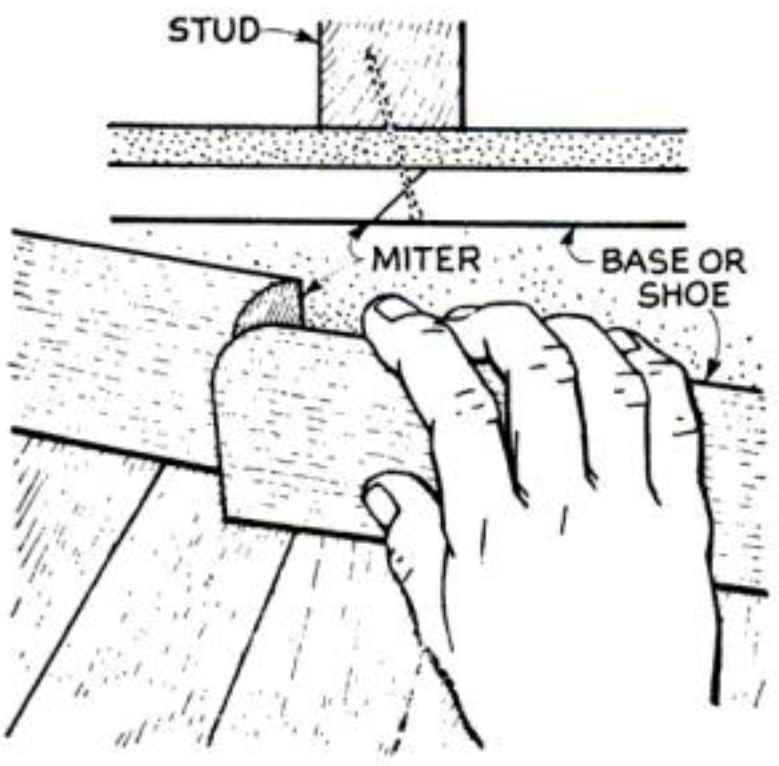
When you fit an old molding to a new one, you may find that the old one is thinner because of shrinkage. Variations may also occur in new molding from different batches. Bring the two pieces to equal thickness by planing the back of the thicker one.



Basics to remember when you're installing baseboard

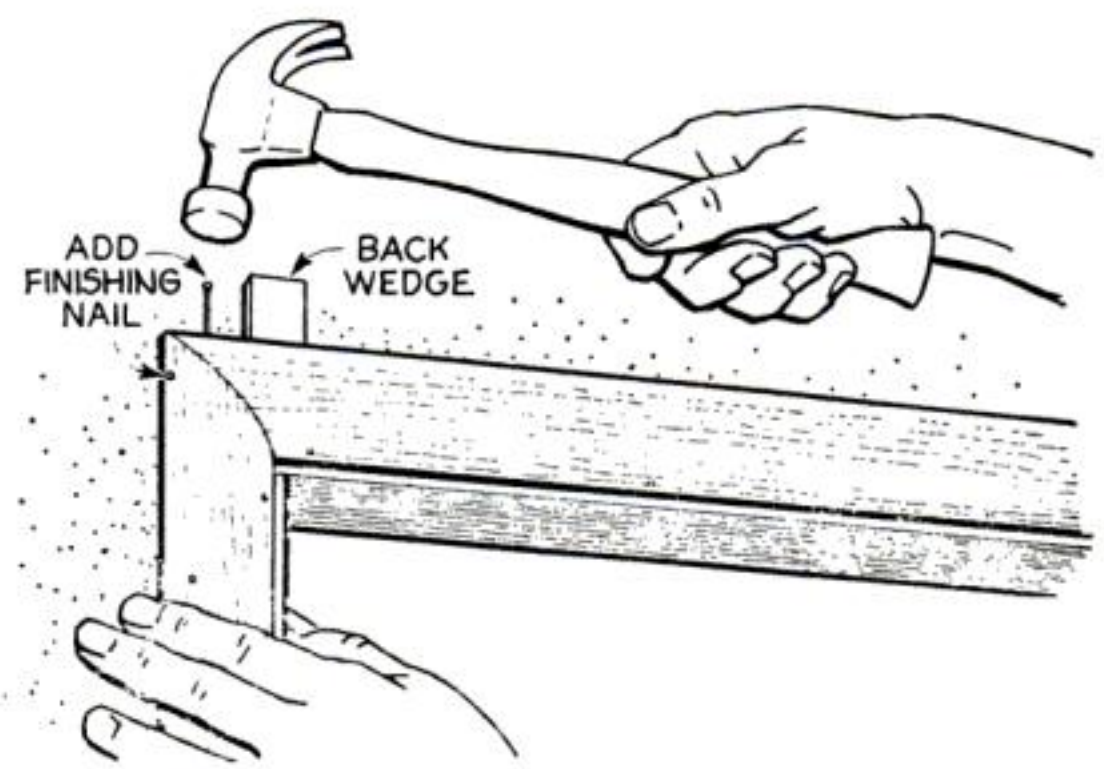
Baseboard can be mitered around outside corners, but inside mitering usually is unsatisfactory. The end of one piece is almost sure to nail back farther than the end of the other, causing an offset. After a time, shrinkage opens the joint.

Coping will bypass both difficulties. Square the end of one piece and butt it into the corner. Then press the other piece against the wall and the installed piece. Mark the profile by using a scriber or compass held parallel to the floor, with the point sliding against the installed piece. Follow the line with a coping saw, undercutting it slightly, and you'll get a good fit. Cut the board a trifle long and you're all set: The joint will be pressed snugly together without a crack showing as the board is sprung into place.



Miter splice at a stud

When it's necessary to splice base shoe or baseboard, cut a miter joint so that it will fall over a stud where the nailing is good. For very small molding, glue gives an even better job.



How you can keep casing corners aligned

Plaster is sometimes skimpy at the top of a door, allowing the head casing to be driven back out of line with the side piece. You can correct this deficiency by driving a wedge behind the top casing, and then cutting it off flush. Strengthen the joint by driving finishing nails into it from both the top and the side.

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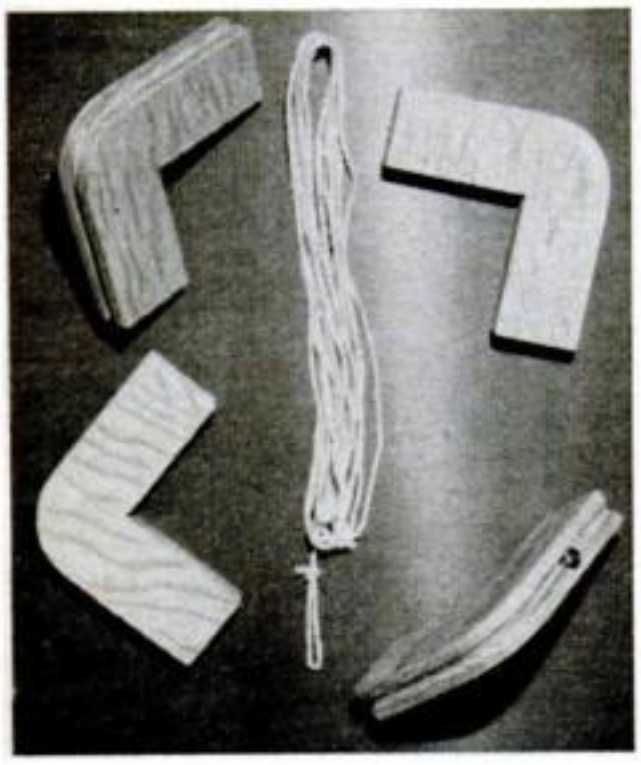
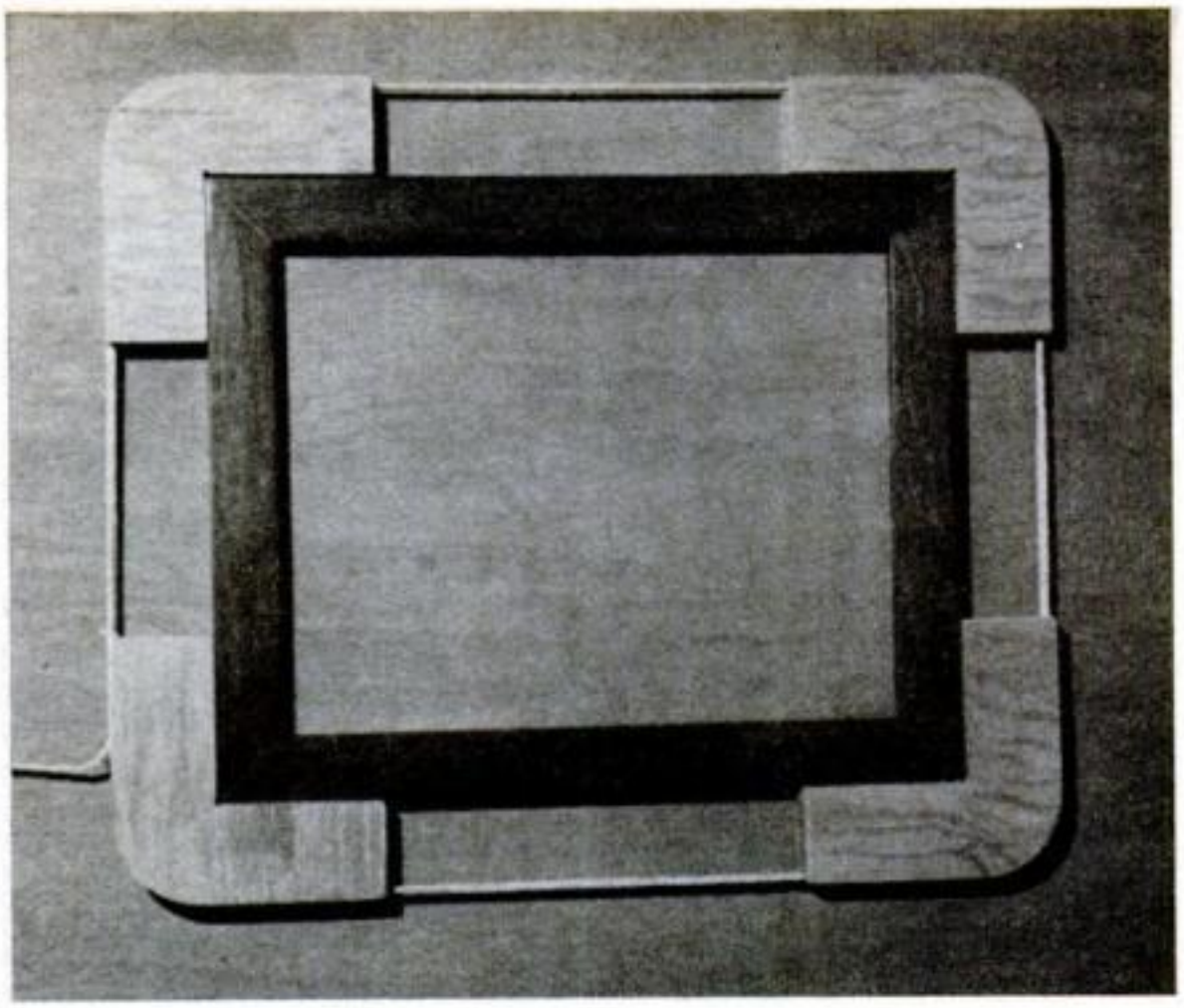
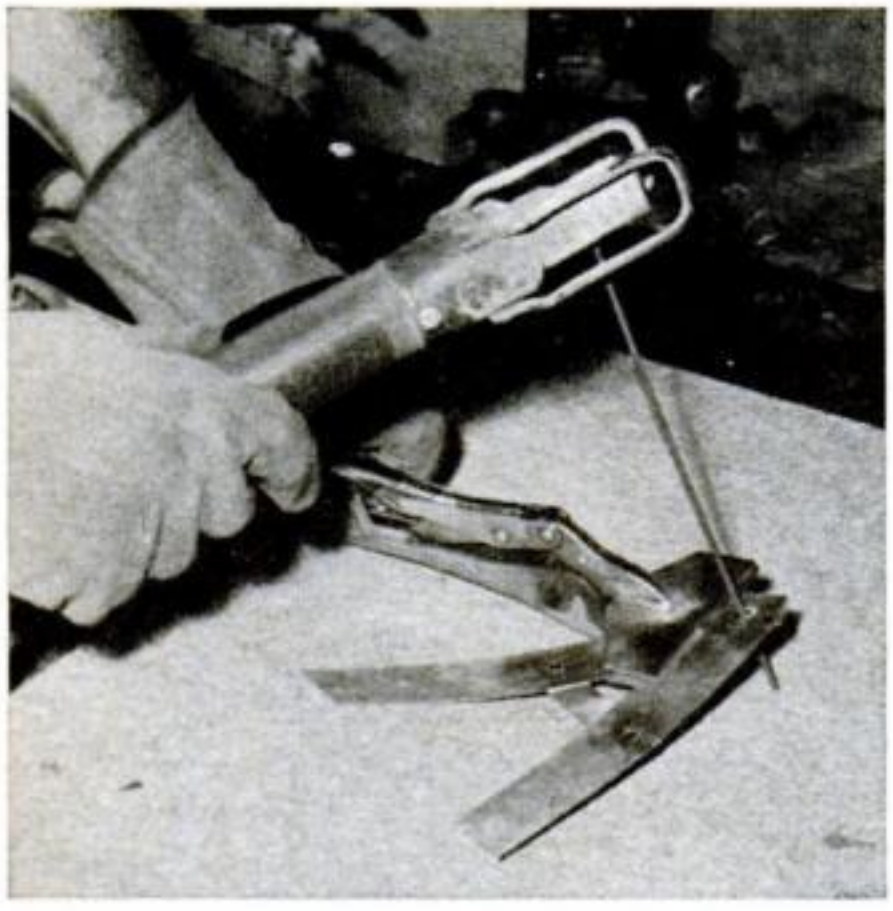
Short Cuts and Tips FROM PS READERS



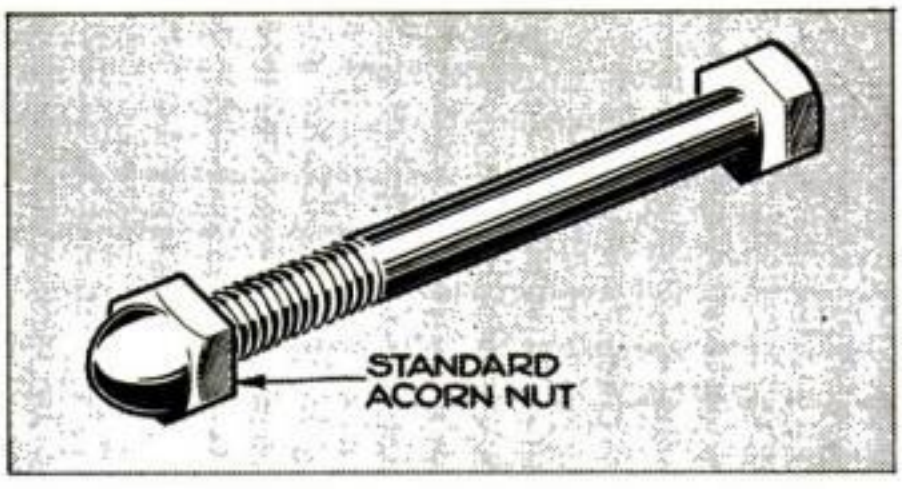


Picture-frame clamp is easy to make

The best miter-clamping outfit I've ever used was made from four pieces of plywood and a chalk line. The parts are shown separately at left, and in use on a frame at right. Grooves were cut in the outer edges of the corner pieces to take the line. (To save cutting the groove, you could build up the pieces in layers.) The line is tied to a screw in one corner piece.—*Ray Layton, Muskegon, Mich.*



▶▶▶ Customers kept pulling price tags from the furniture in my furniture shop. The problem: to reinforce the eyelets on some 5,000 light cardboard tags. Using a squeeze container of white glue, I laid a ring of glue around each eyelet hole. After the glue had hardened, the cord couldn't tear out.—*H. B. Pratt, Watchung, N.J.*



Arc welder fuses thin metal together

Thin sheets of metal can be joined with an arc welder. Set the heat at about 145 amps and use a ⅛" electrode of the type that's dragged along without striking an arc. Punch straight through the pieces to be joined. This leaves a small hole, around which the pieces of metal are fused together.—*W. G. Waggoner, Sacramento.*

Acorn nut serves as peening tool

Faced with the problem of peening some metal in a spot where I couldn't swing a ball-peen hammer, I tightened an acorn nut on a hex-head bolt. With the nut placed against the work, the bolt head was in the clear—and I could tap it with a hammer. An acorn nut is an excellent shape for peening.—*Roger Isetts, Kenosha, Wis.*

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Big Light in a Little Package

By John H. Ingersoll

TAKE an auto-light bulb, a transformer, a shoestring length of low-voltage wire, a bit of styling, and you'll wind up with any one of the high-intensity lamps in the photo at right. They're that simple.

This new type of lamp has caught on so quickly that even the inventor, Jay Monroe of Brooklyn, N.Y., is still blinking. An engineer, he knocked together the prototype in 1959, sold the first commercial model in 1960, and now heads the $3-million-a-year Tensor Corp.

Voltage is the essential difference between a miniature lamp and a standard one. The transformer knocks down 115 volts at the socket to either 6 or 12 volts, depending on the auto bulb used. The decline in voltage raises the current, which increases the filament temperature—and produces a brighter, whiter light.

Wiring diagram shows typical parts of all the new high-intensity lamps. In the photo at top are shown, from left to right: a Lampette, two lamps by Stiffel, the original Tensor lamp, a Fulton, and a Laurel.

Whiteness in the light beam considerably sharpens the definition of surface colors. For that reason alone, such people as dermatologists and textile salesmen have been grabbing off the lamps fast. Not far behind are modelmakers, draftsmen, and wood or metal craftsmen. Miniature lamps are helpful in the shop because they sharpen the definition of light and shadow—better visibility for detail work on power tools.

In buying a miniature lamp, ask the salesman which of three UL-approved safety systems is built into the lamp. Here's why:

The best lamps have an automatic-reset circuit breaker. Put the wrong bulb in, and you'll get only less light or blinking light. Other makes break the current with a fuse. But UL insists that it be tamperproof. So a blown fuse must be replaced by the manufacturer. The third method employs a current-limiting (or self-destroying) transformer. This also means an annoying trip back to the maker.

Miniature lamps that fold up or have movable arms cost from $18 to $25. Gooseneck varieties are less—from $6 to $10. But you can pay as much as $130 for others—the extra going for unusual design and more decorative materials.

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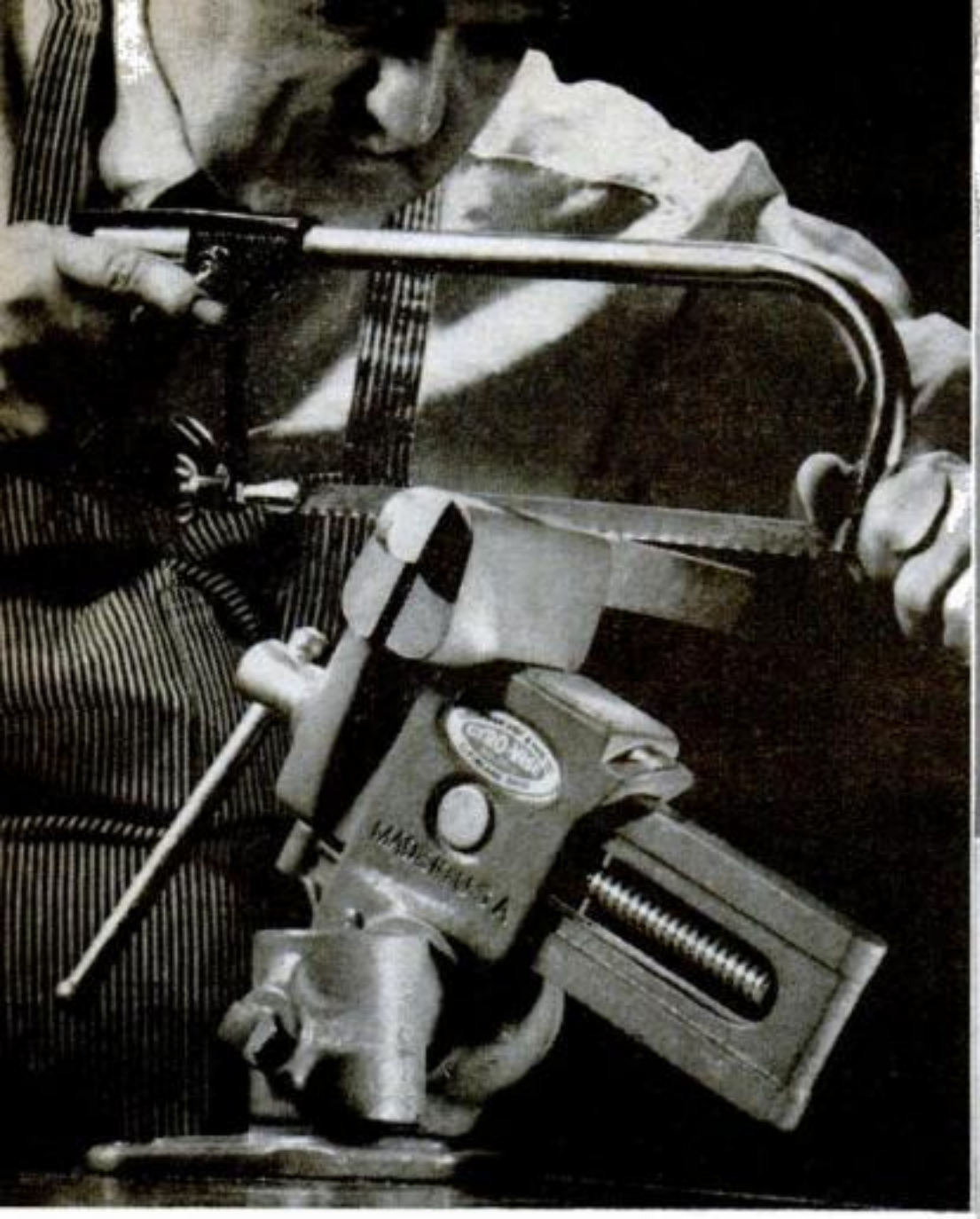

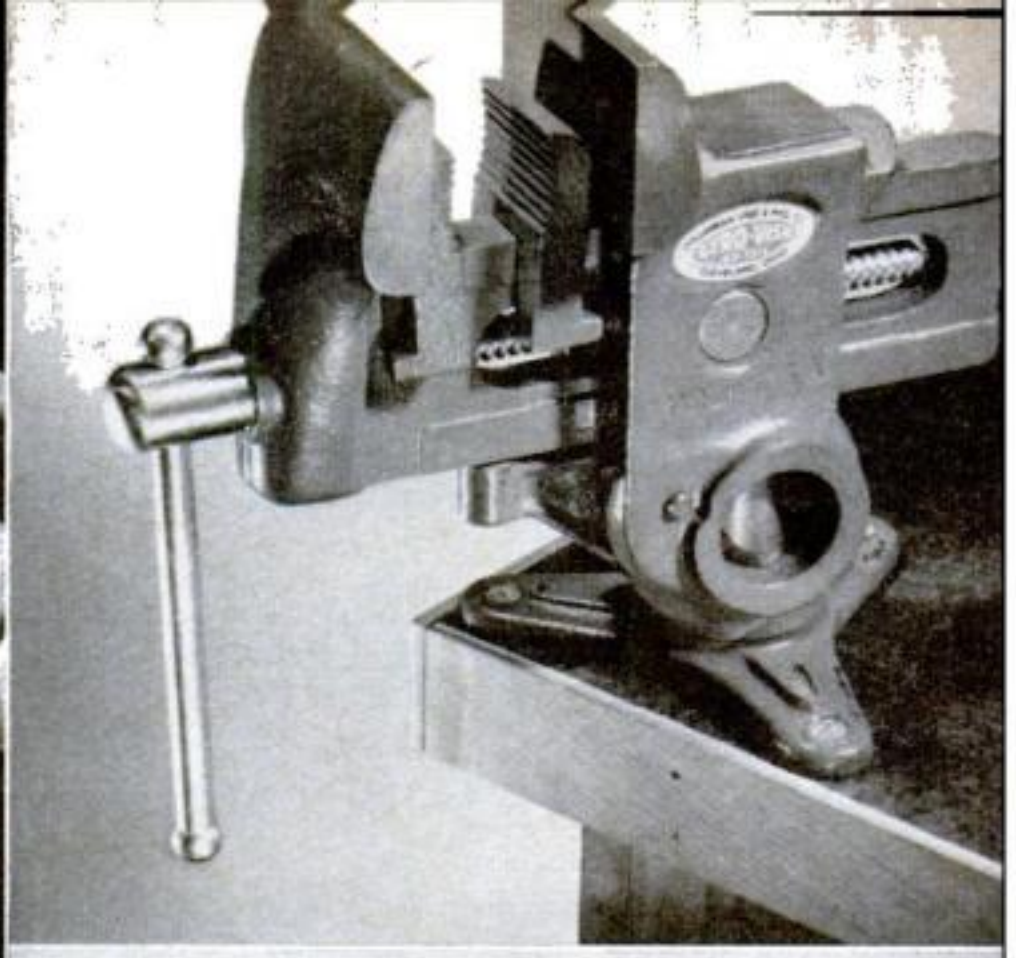

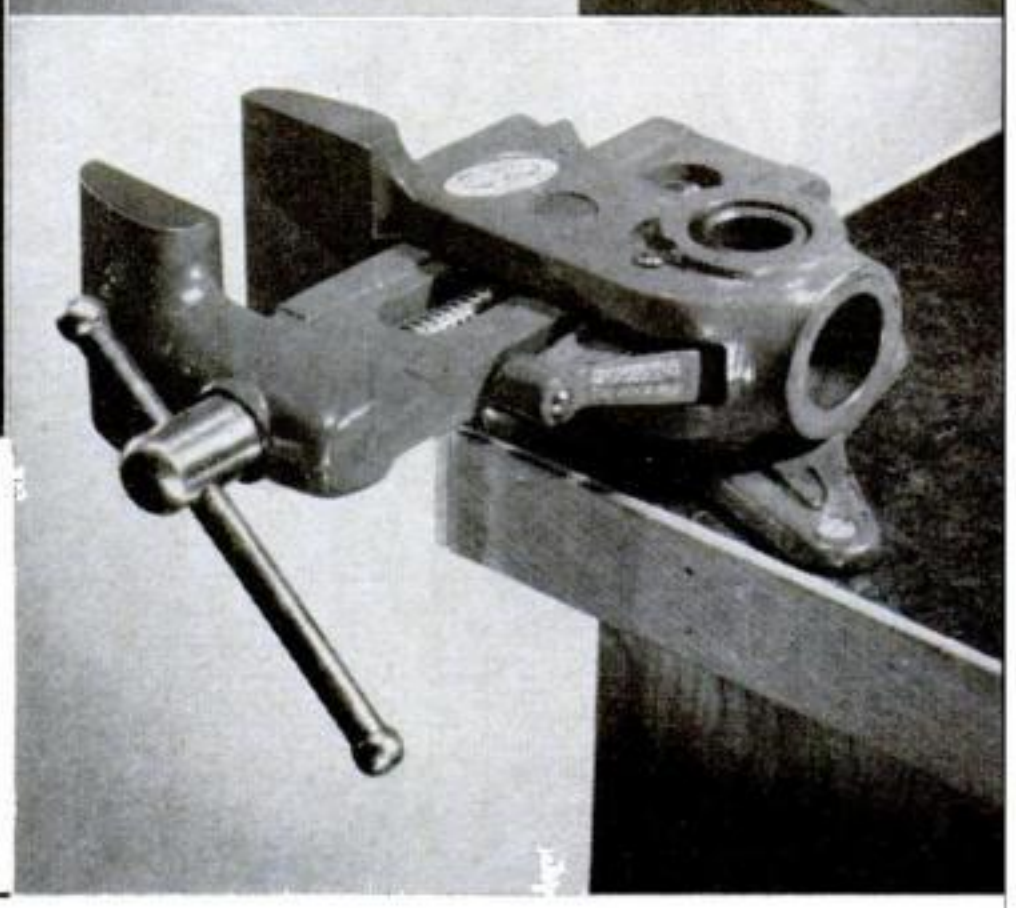

Unusual all-angle vise mounts on a post and swivels 360 degrees. It can be used upright (top photo at right) or on its side (lower right). With a collar adapter, it can also tilt, as above. It locks automatically in position as you tighten the jaws. Extra post mounts are available so you can use it in various locations. Columbian Vise & Mfg. Co., Cleveland, sells the Gyro-Vise for about $15.

Which Shop Vises

THERE are more than a dozen different kinds of shop vises on the market. That's a lot to choose from. You don't need them all, but you may well need more than you realize. The big question is: Which ones?

The answer depends on the kind of work you do. Most shops need at least two vises just for routine jobs. From there on, it's a matter of matching specialized vises to specialized needs. For a broad range of shop operations, you'll probably need four basic types. You may even find you want two or more of the same type—it's sheer joy to be able to hold long work at both ends between a pair of vises.

Here's a guide that will help you pick the best vises for your shop:

The bench vise. Also known as a utility or workshop vise, this is the one for all-around work. It's the familiar, massive, powerful-jawed workhorse that mounts on top of a bench. Its jaws typically deliver a squeeze of 10,000 to 15,000 pounds. It

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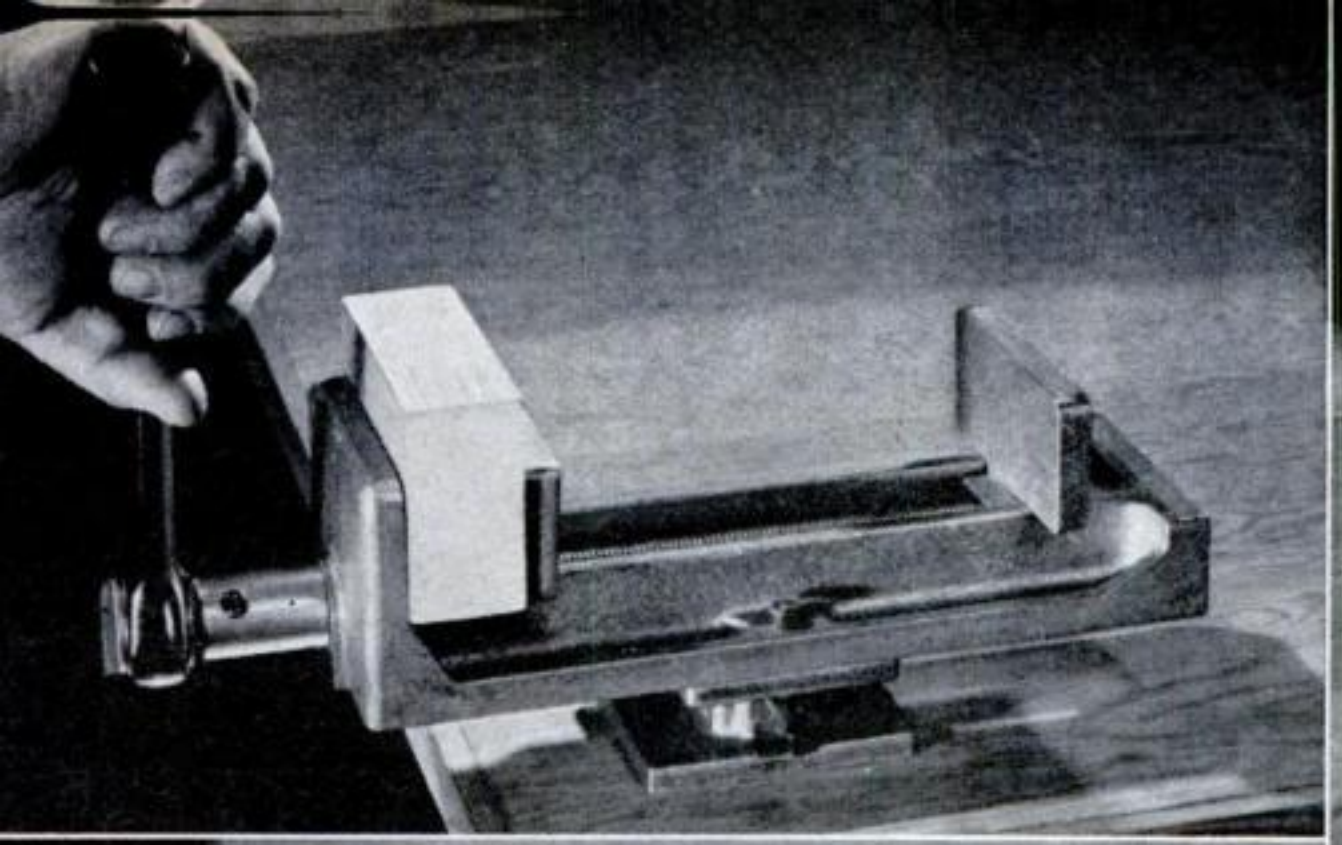

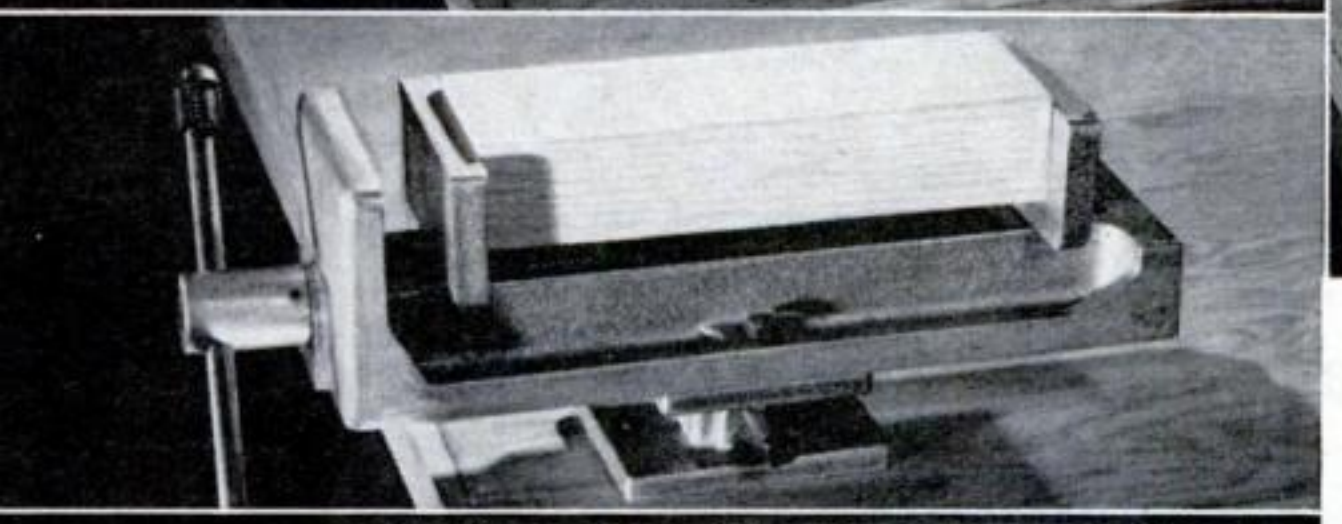

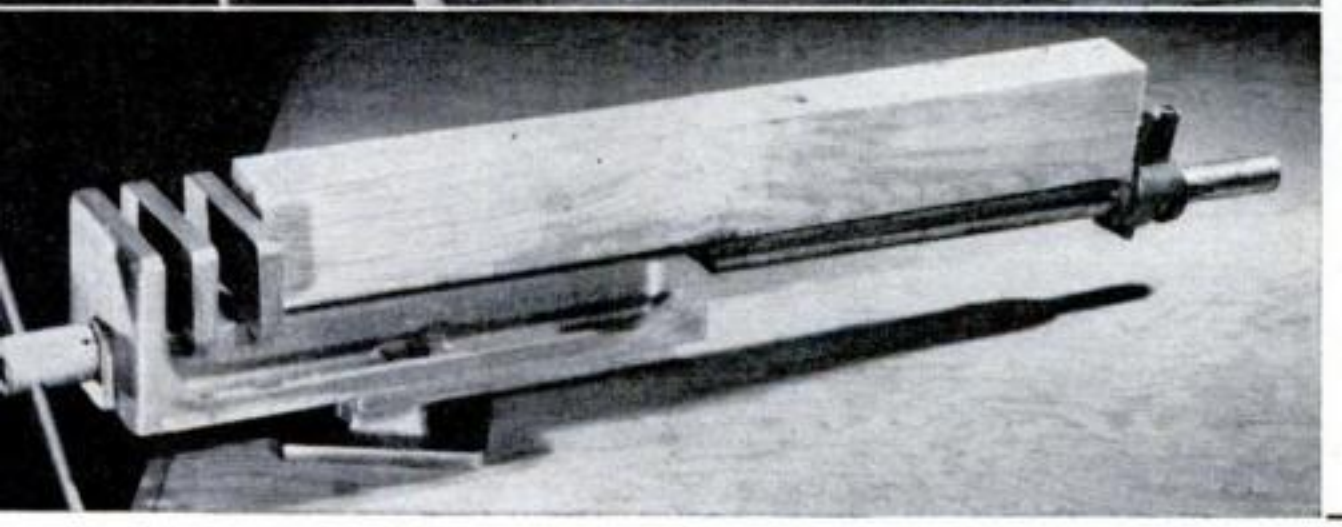

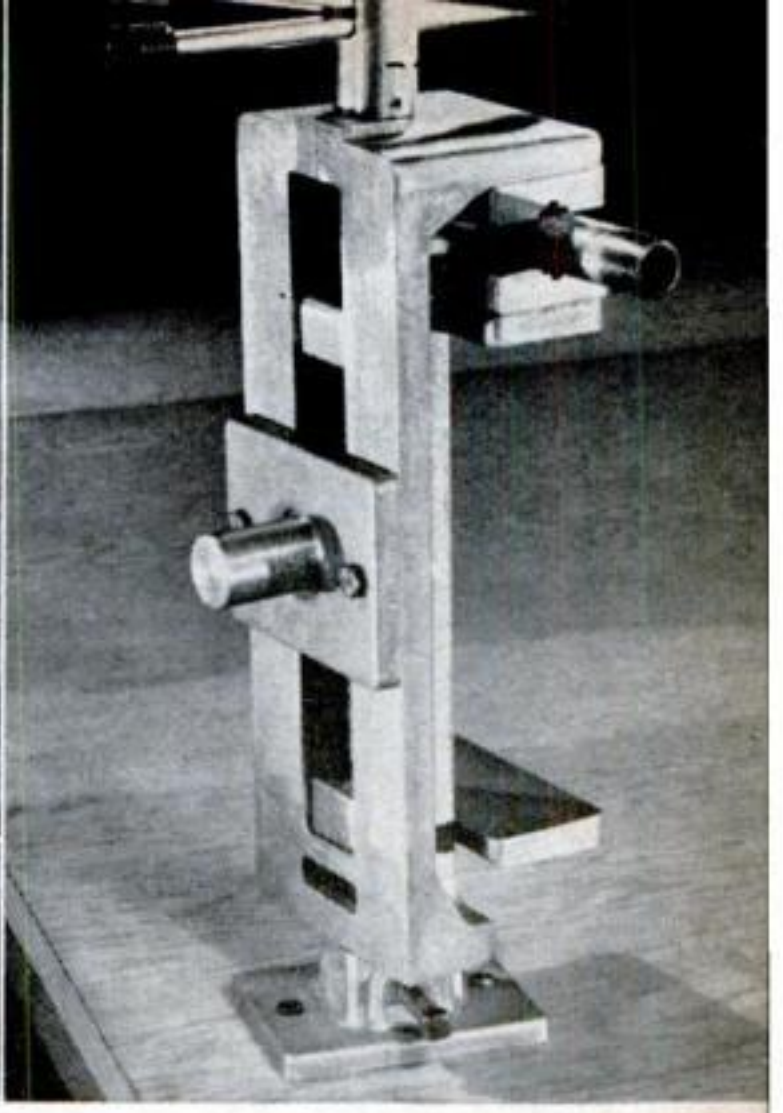

Combination vise and clamp, one of the newest designs, has two movable jaws and one fixed one that can be arranged to suit different-size work. With a standard pipe-clamp extension (bottom, left), it can hold work of almost any length. It has a swivel base, pipe-jaw inserts, mounts flat or on end. For extra force, the screw has a square socket to take a ratchet handle (top left). Price is $19.95 from the Dennis Vise and Clamp Co., 32 W. 9th St., Mesa, Ariz.

PS TOOLS

Do You Need?

By George Daniels

should be the first purchase for any shop.

The bench vise is designed for holding metal. Its narrow jaws will mar wood. Even on metal, it's important to pick the right jaw face. If you want the firmest grip, select jaws with serrated faces. If you want to minimize marring of finished work, choose smooth-faced jaws. It's also possible to get smooth-jaw caps to slip over regular serrated jaws, giving you both. These come in different metals such as brass, copper, and lead. The idea is to select a metal that's softer than your work, to prevent marring.

Better-quality bench vises have interchangeable jaw inserts, but this doesn't mean you can change from one type to another quickly. The switch requires knocking out pins or removing screws—a chore you're not likely to bother with in the middle of a job. The feature—a good one—is intended mainly for replacing worn jaws.

Which type of bench vise? The swivel-base type is fast becoming the most popular, although the original stationary-base

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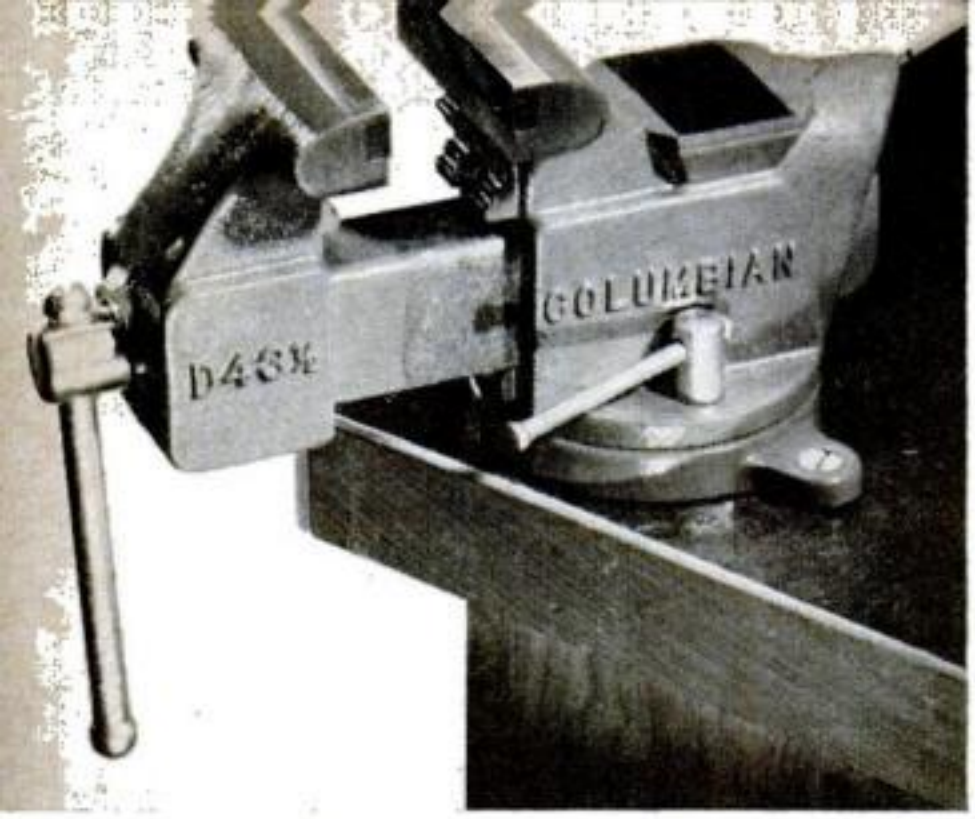


PORTABLE CLAMP-ON VISE

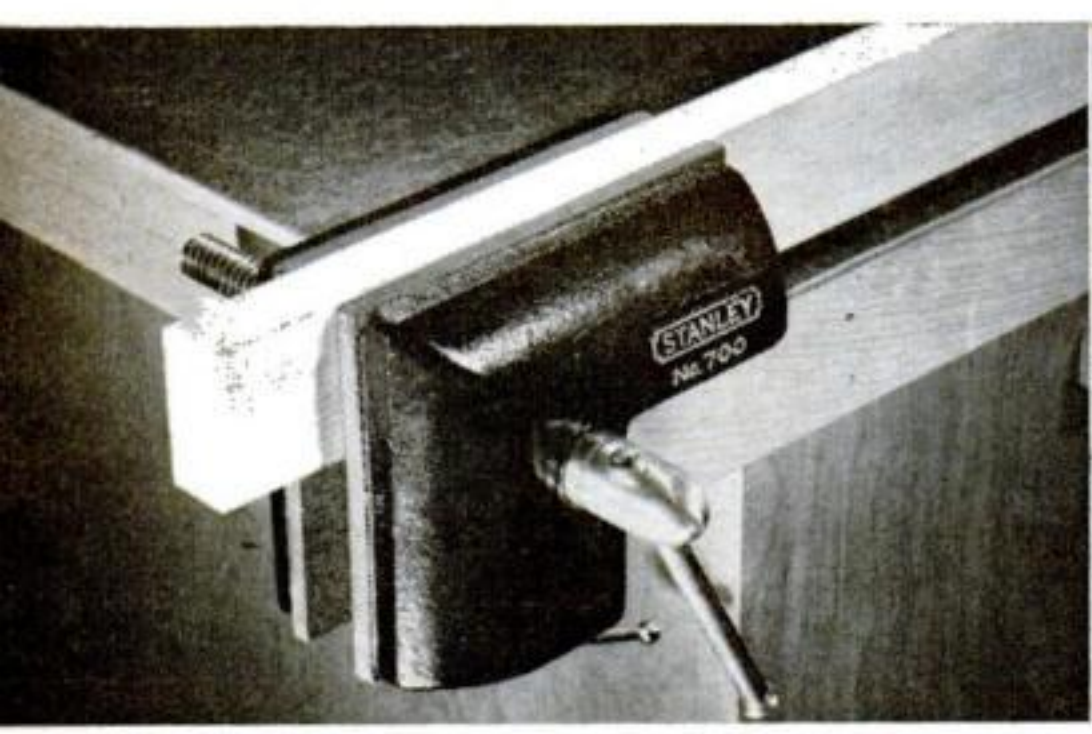
SWIVEL-BASE, SWIVEL-JAW VISE

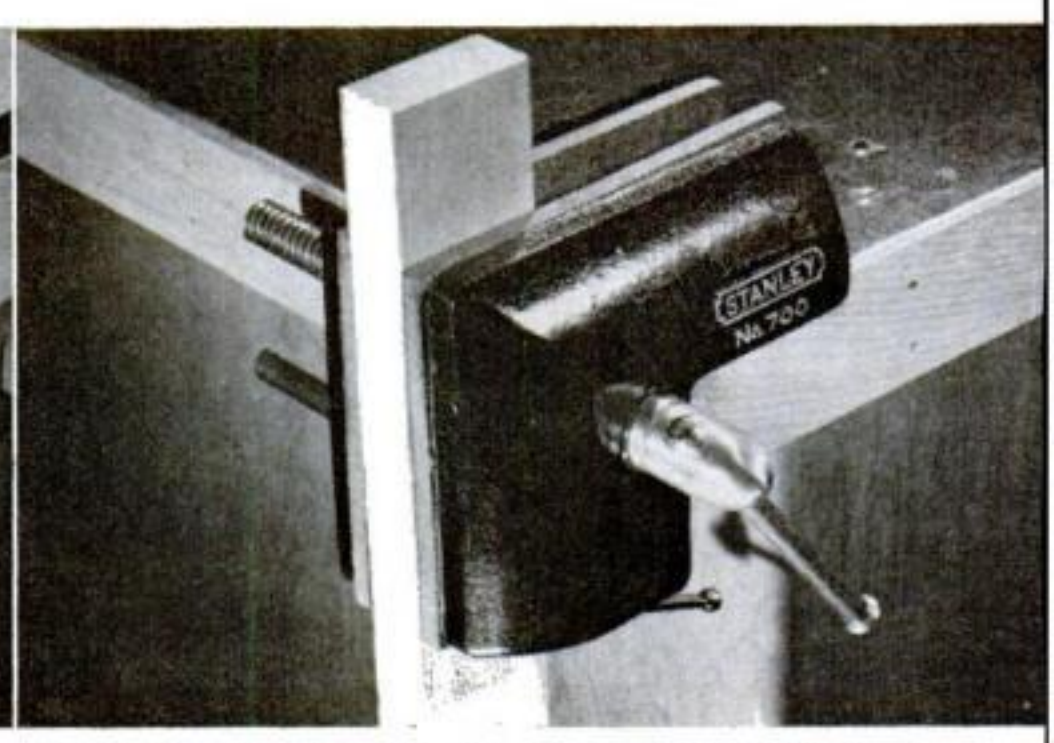
FIXED-BASE, FIXED-JAW VISE

SHEET-METAL VISE

Even the common bench vise comes in many styles

Swivel-base bench vise (above), most popular type, is more versatile than fixed-base style, but the latter is cheaper. The one shown, a Columbian, has auxiliary pipe jaws below the main jaws. Clamp-on version is handy for light work, can be moved from job to job, but is not as sturdy as a permanent bolt-on base. Other forms include a swivel-jaw vise for holding tapered work and one with sharp-pointed jaws for bending sheet metal cleanly.

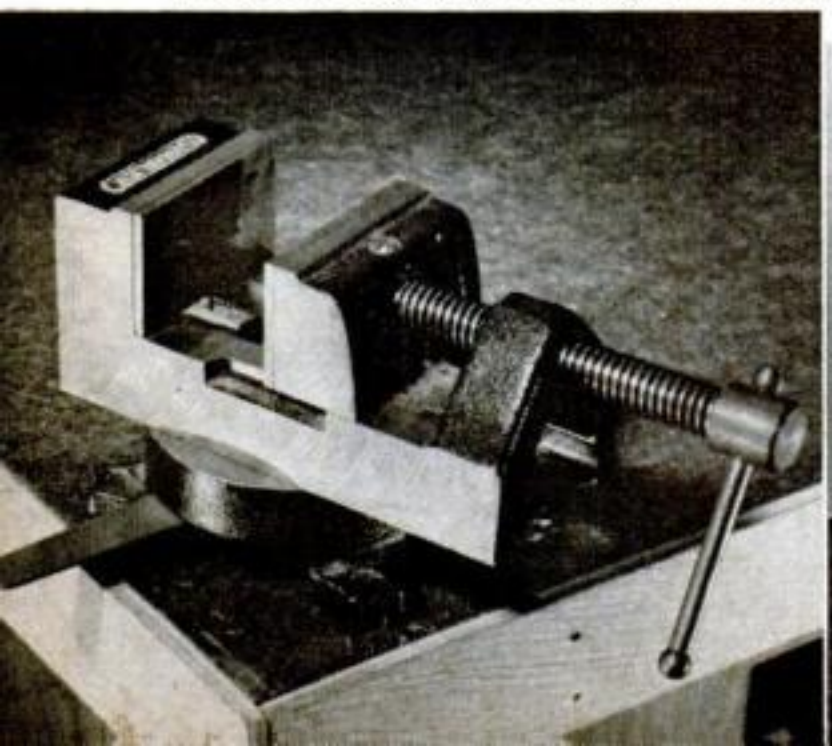


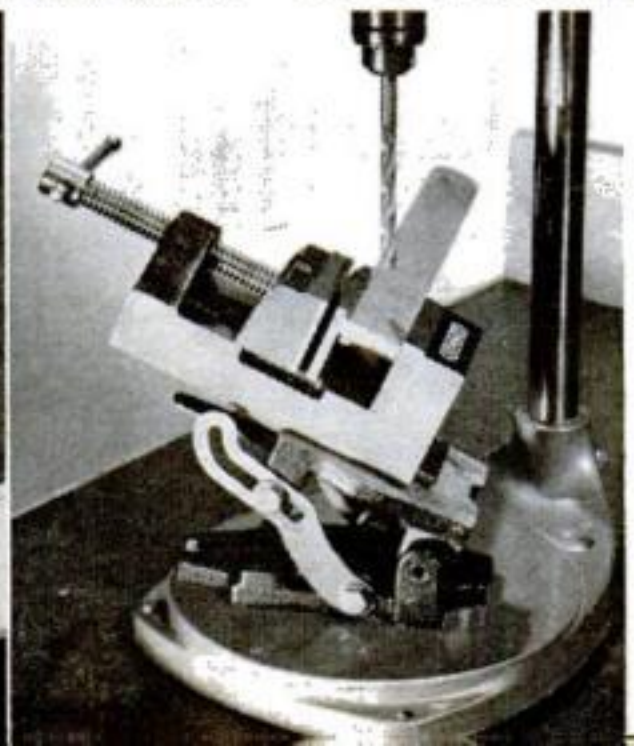


Two-way carpenter's vise is a fine extra type to own. Its two-direction jaws hold work either horizontally across a bench (above, left) or vertically off the end of a bench (right). For portable use, it can be clamp-mounted to a saw horse, heavy plank, or stair tread. One shown here, made by Stanley, New Britain, Conn., is about $5 in aluminum, $7.50 in iron.

Machine vises swivel, tilt, and slide for precision work

Machine vises put the work exactly where you want it for drilling, milling, other delicate jobs. Most common is tilt-base type (below, center). This bolts to a drill-press table, holds work at any angle. Simpler version has nontilt base; fanciest has a calibrated turret base for precise indexing jobs. Type at left serves as either a bench or tool vise, has swivel base plus sliding carriage for positioning work. Vises shown in photos below are by Stanley.

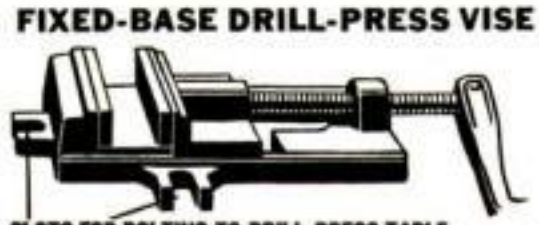




SWIVEL-BASE
MILLING-MACHINE VISE

REMOVABLE TURRET BASE
CALIBRATED FOR INDEXING

FIXED-BASE DRILL-PRESS VISE



SLOTS FOR BOLTING TO DRILL-PRESS TABLE

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You have two types of pipe vises to choose from

design is still made. The slight difference in price and the advantage of being able to rotate your work to any position make the swivel base much the better buy.

Jaw width ranges from about 3″ to 5″. As the width increases so does the jaw-opening distance—important to remember. Usually, the amount of opening is slightly greater than the width—3½″ jaws, for instance, have an opening of about 4″. Prices for swivel-base bench vises start at about $8 in the 3″ jaw size.

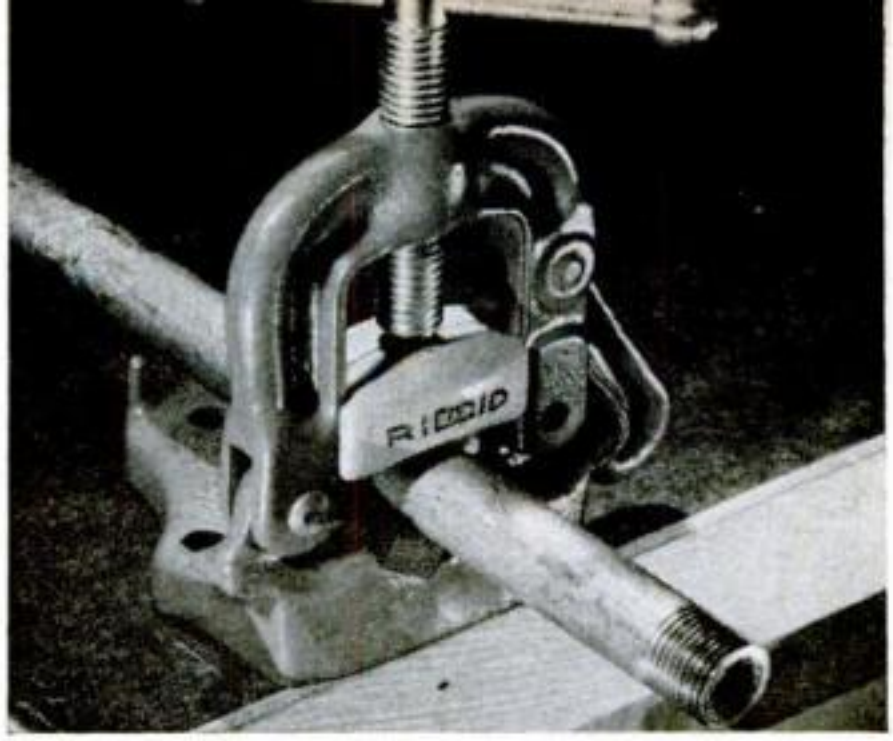
The better types should have a pair of auxiliary pipe jaws below the main jaws. These curved, toothed jaws grip round stock. They're handy to have, especially if you don't do enough pipe work to justify buying a regular pipe vise.

The jaw-tightening screw is exposed in some models, and in others is enclosed in a sliding beam. The enclosed type protects the screw threads from metal chips and abrasive particles. If you pick the exposed type, keep the threads clean.

The clamp-base version is handy because you can remove it quickly to clear a bench top or carry it to other jobs, but it is intended only for light duty. It won't take the knocks that a permanently mounted vise can. Pick it mainly as an extra helping hand. Jaw sizes range from 1½″ to about 3½″. Prices start at around $2 for the smallest sizes.

What's a machinist's vise? This is actually a heavy-duty version of the bench

[*Continued on page 198*]

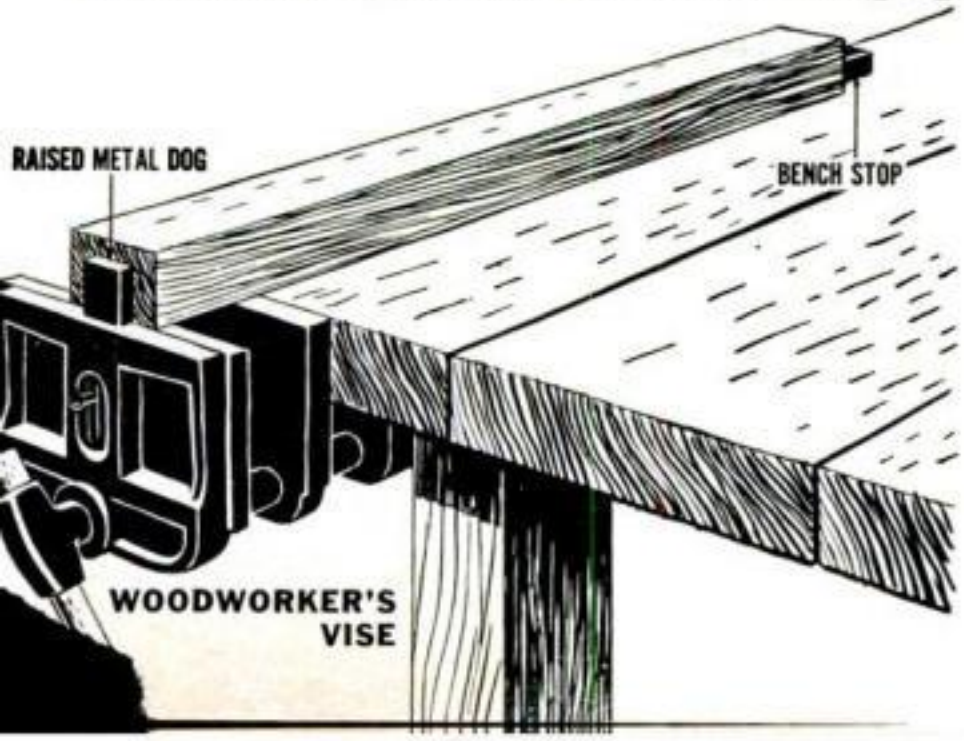


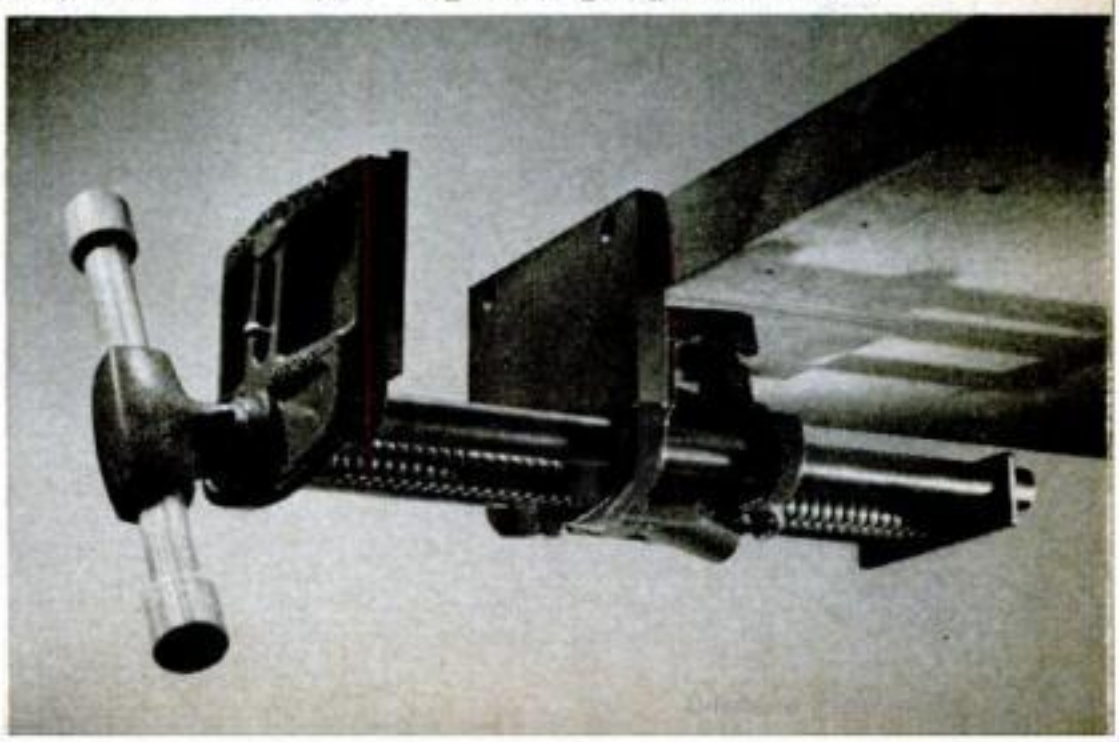
Yoke-type pipe vise clamps round stock between two curved, serrated jaws. Yoke pivots open at the side to let the work in. Models above and below are made by Ridge Tool, Elyria, Ohio.

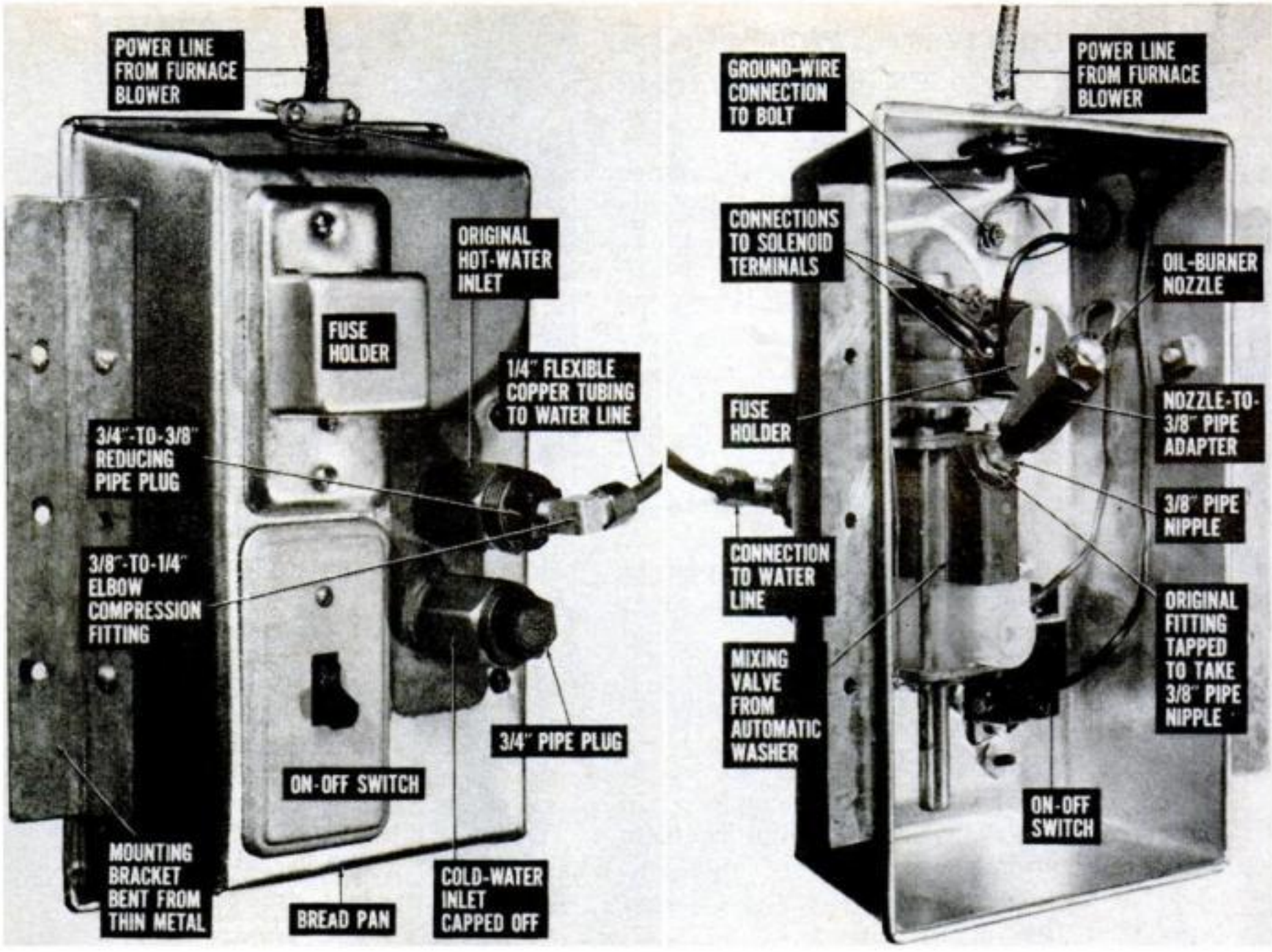
Chain-type pipe vise uses a chain to draw work tightly against one fixed jaw. This is somewhat more adjustable than yoke type, can also hold odd-shaped work as well as round stock.

The classic woodworker's vise—still a shop workhorse

Under-bench mounting is big advantage of this vise. It keeps bench top clear and holds work low for easy sawing or planing. Better-quality types have a metal dog in the outer jaw that can be raised above bench level for clamping oversize work against a bench stop, as at left. Another mark of quality: quick-acting jaws. This sturdy Columbian model can be slid in or out for fast jaw setting. The screw engages only for final jaw tightening against work.







Mixing valve from an old clothes washer—heart of the humidifier—fits neatly in a 6"-by-10" bread pan along with other parts. Openings for the valve's inlets and the switch and fuse holder are cut with tin snips, can be rough. Note at right how the nozzle mounts on the valve at a natural angle that's ideal for spraying water into the furnace air stream.

Make your own

Water-Spray Humidifier

By Arnold N. Anderson

A SPRAY-TYPE humidifier for a warm-air furnace is an expensive installation. Here's one you can build for a few dollars' worth of spare parts. It even works automatically, spraying a fine mist into the air as long as your furnace blower is running. When the blower stops, the humidifier shuts itself off, too. The unit will maintain a typical five- or six-room house at a comfortable 40-percent relative humidity in dry winter weather.

The use of two common parts makes the humidifier easy to assemble. The spray jet is simply an oil-burner nozzle, costing about $1 at an oil-burner service shop or heating-supply house. The water control is an electrically operated solenoid mixing valve scrounged from an old clothes washer. These valves are usually available for a few dollars from junked machines at appliance-service shops. If necessary, you can buy one new for about $10.

The valve has two inlets, one originally for hot water and one for cold. You can connect your water supply to either one. The inlets have ¾" pipe threads. With stan-

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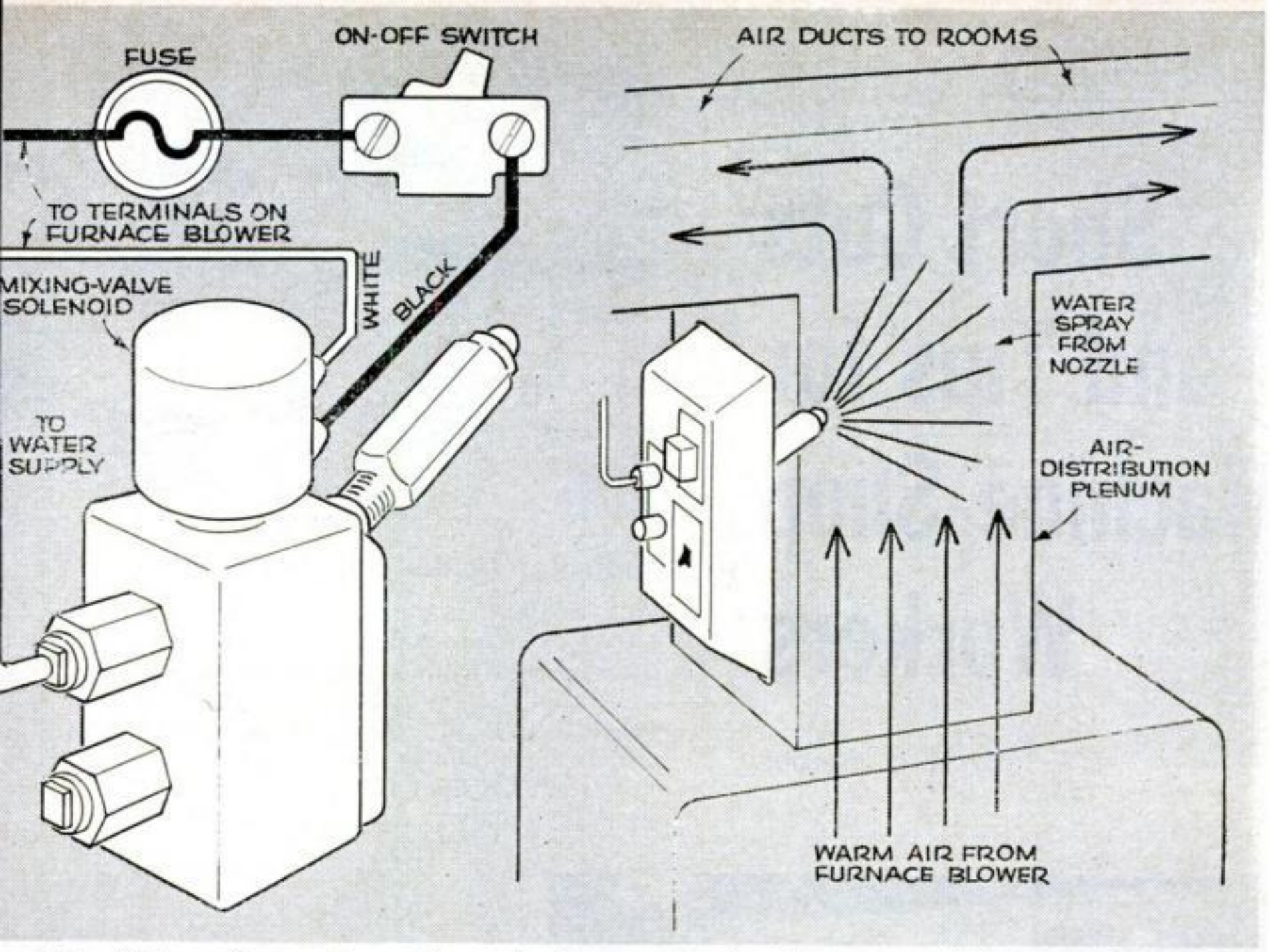

Humidifier unit mounts on furnace's plenum chamber where it can spray mist into air leading to all house ducts. It's necessary to cut only a small hole in the plenum for the spray nozzle. The unit itself fastens on the outside with sheet-metal screws. Sketch at left shows how water-control valve is wired through a switch and fuse to the furnace blower.

PS HOME IMPROVEMENT

for a Warm-Air Furnace

dard fittings, you can run pipe or tubing to a nearby cold-water line (I used ¼" tubing, but any size will do). The easiest way to tap into existing plumbing is with a clamp-on saddle connector, available at plumbing shops.

For the jet, use a burner nozzle with a fine orifice (.85 or similar) and a broad 80-degree spray pattern. If your furnace duct is very narrow, use a 60-degree nozzle. You'll also need the special fitting that adapts the nozzle to ⅜" pipe.

Attaching the nozzle requires a bit of surgery on the valve. The original outlet is a nonthreaded hose fitting. It's best to hacksaw this off and drill and tap the remaining hole to take ⅜" pipe (a plumbing shop will do this for you if you want). The nozzle can then be attached with a short ⅜" pipe nipple.

The only wiring you need do is to run a BX or Romex cable from the solenoid on the valve to the junction box on your furnace blower. This way, the humidifier will operate only when the blower is on. For precise moisture control, you can add a humidistat, available for about $8 at stores that sell commercial humidifiers.

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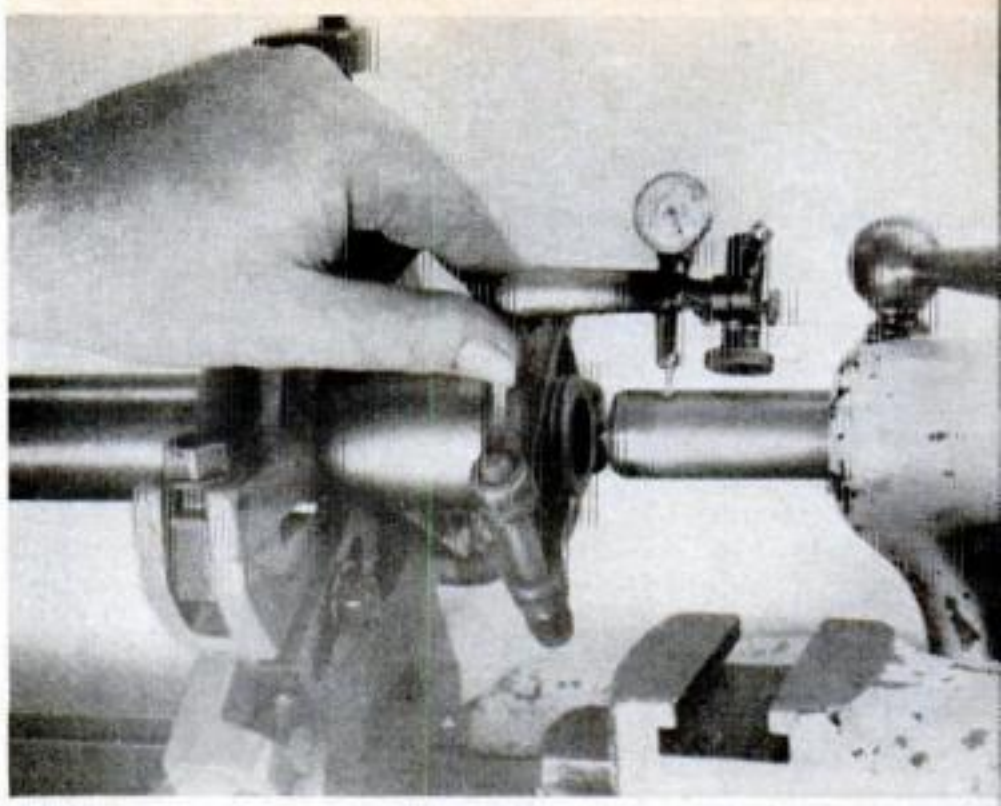
PS METALWORKING

Short Cuts and Tips for Machine-Shop Workers

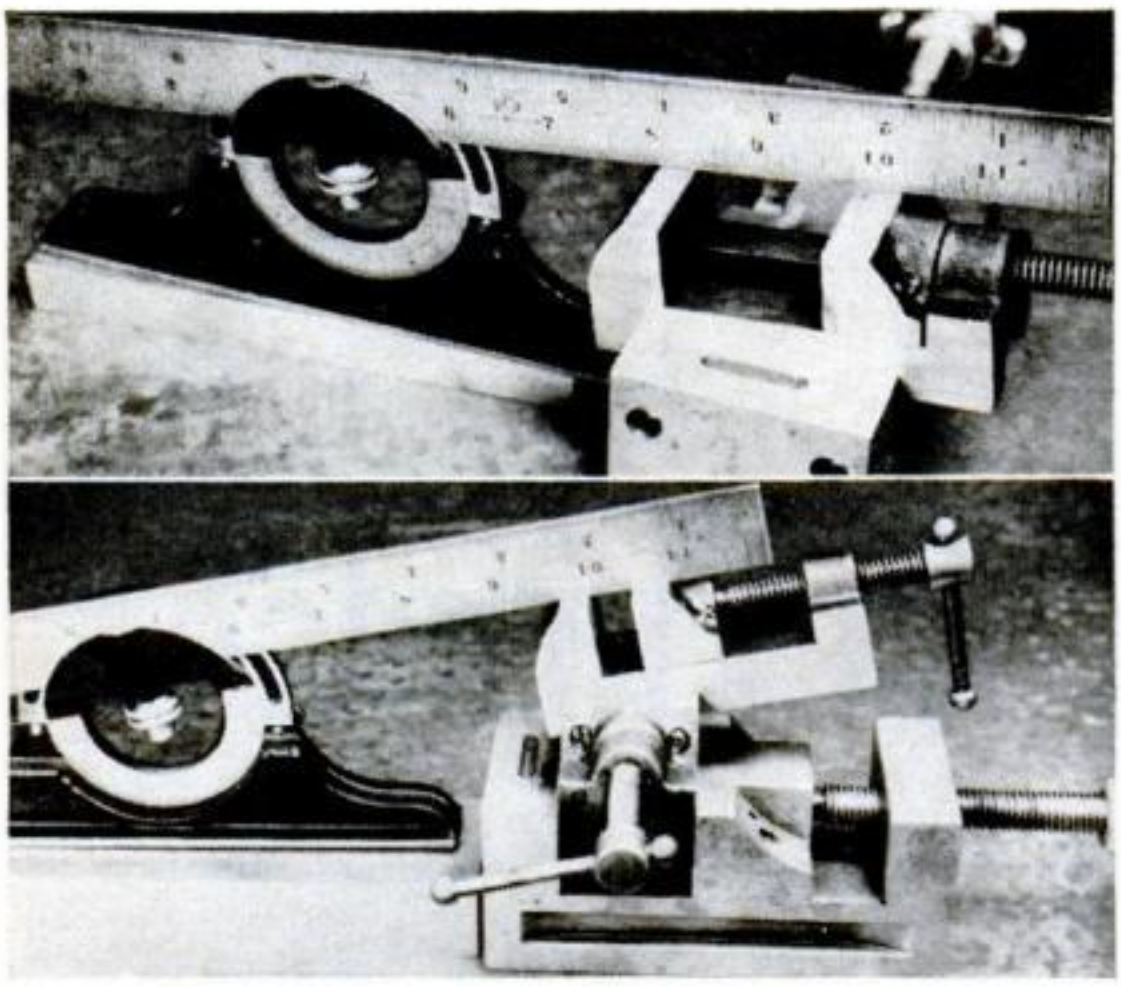
By H. J. Gerber



Indicator holder has many uses

A 5/16″-diameter stem welded to the tail of a clamp-type lathe dog converted the dog into a multipurpose holder for my small dial test indicator. The stem, a piece of drill rod, fits the universal swivel to which the indicator itself is attached.

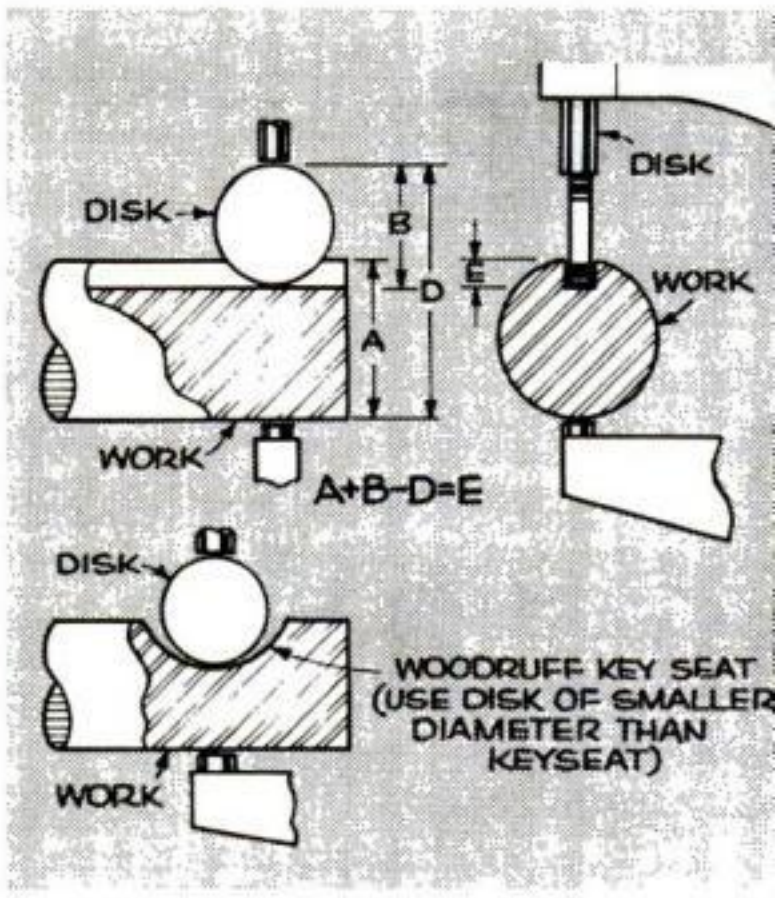
The photos show three ways in which I've used the holder. Above at left, it centers



Combine two or three vises to machine angles

You can create a substitute for an angular vise by teaming up small vises. For a single angle, use two as in the photo at top, the base of one clamped in the jaws of the other. Adjust the angle with a protractor while the setup is seated on a surface plate. Add a third vise, as in lower photo, for a compound angle.

These setups are fine for light drilling and surface grinding. I've also used them for light milling. For the latter, hold the secondary vises directly in the regular heavy-duty milling-machine vise.



Formula gives keyway depth

Even if you have a depth micrometer, it's sometimes difficult to measure the exact depth of keyways you're milling. But there's an easy way to do it with ordinary micrometer calipers.

Cut a thin disk, one that is narrow enough to fit freely into the slot. A slice sawed off a bar of cold-finished steel will do. Use your calipers to set up the formula shown in the drawing above.

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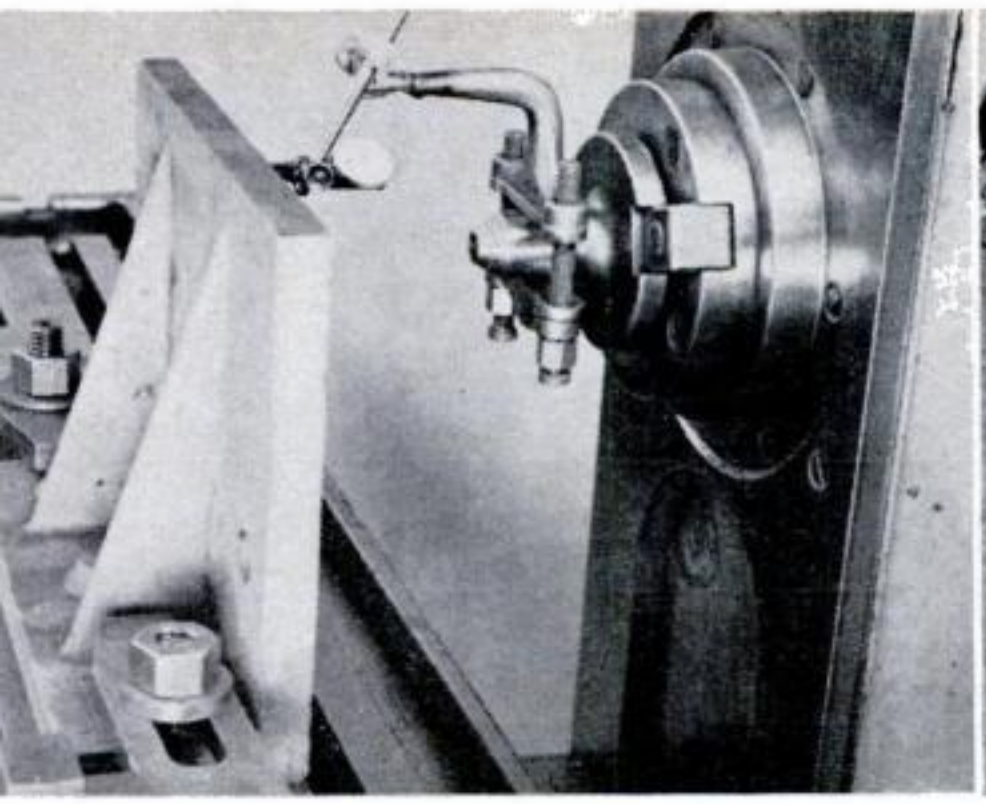
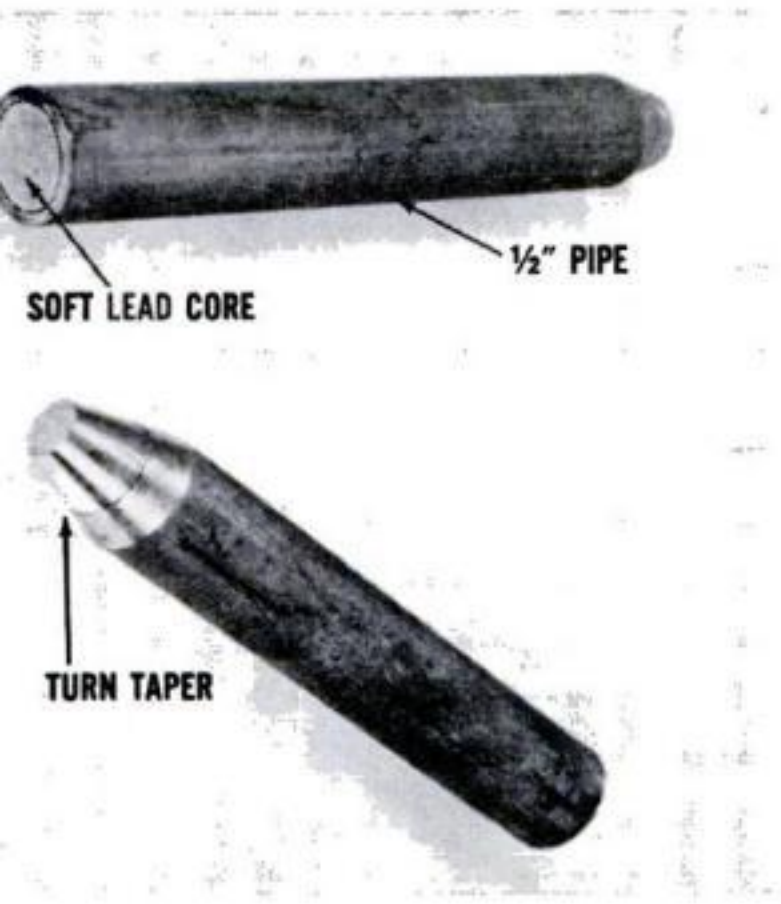


work in a lathe steady rest. Clamp the dog on the protruding end of the work and use it as a swing-around tester to center the work with the lathe tail spindle. If the dial shows run-out while you're hand-rotating the work, adjust the jaws of the steady to correct the alignment.

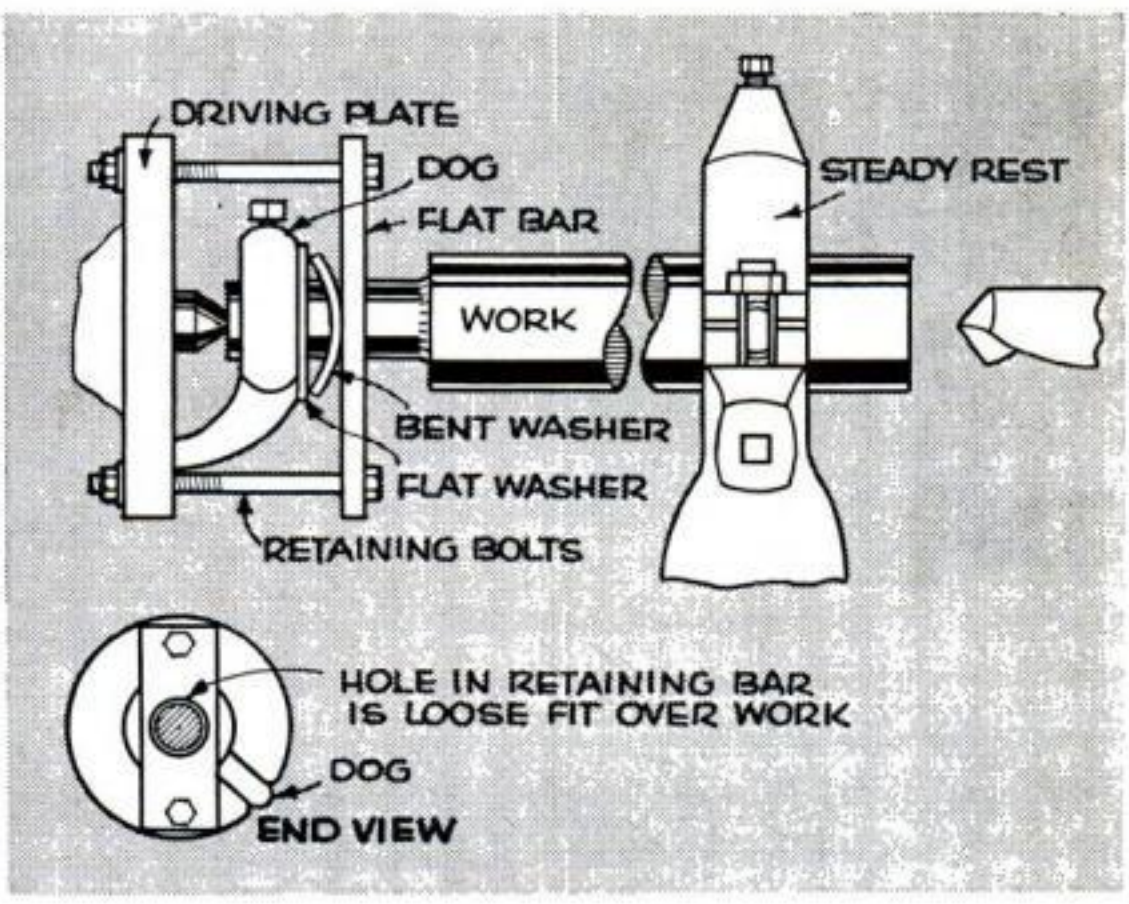
Clamped to the spindle nose of a milling machine (center photo), the device makes possible quick squaring up of angle plates on the machine table. Readings are taken at each side by hand rotation of the machine spindle. When the dial reads the same for both side positions, the plate is seated at right angles to the spindle.

Clamp the dog to a drill-press quill, adjust the indicator to bear on the surface of the work (right), and you have a precision stop for drilling a series of holes to uniform depth.



Soft-nosed drift punch

Use a lead-core drift punch when you dismantle or assemble tightly fitted parts and you won't have to worry about denting or marring a fine finish. I make them by pouring molten lead, or scrap bearing babbit, into a piece of ½" or larger pipe, and turning one end to a taper. When this end becomes battered or mushroomed, it's a simple matter to chuck it in a lathe and re-turn it.



A better work holder for a steady rest

Various improvisations are used for securing steady-rested work tightly against a headstock center in a lathe while the piece is being end-worked. None I've tried are as satisfactory or easy to set up as the one shown here. A flat bar, drilled to fit loosely over the work, is bolted to the driving plate. Between bar and lathe dog, I place two large washers, one flat and the other (at least ⅛" thick) sharply bowed.

The bowed washer is the heart of the idea. It's an equalizer to centralize the pull-back pressure and prevent springing of the work. It also acts as a spring to keep the work tightly against the head center.

Urheberrechtlich geschütztes Material

The POPULAR SCIENCE

	TYPE	COLOR RANGE	WASHABILITY	ADHESION	SHEEN	DRYING TIME	COVERAGE
		CHARACTERISTICS					
WATER-BASED	POLYVINYL ACETATE	Unlimited	Good	Excellent adhesion over virtually any nonglossy surface that is clean	Velvety	1 hour to recoat[4]	Virtually all interior paints and enamels cover about 500 square feet per gallon
WATER-BASED	ACRYLIC	Some limits in darker colors	Excellent		Flat	1 hour to recoat[4]	
WATER-BASED	BUTADIENE STYRENE	Some limits in darker colors	Good		Velvety	2 hours to recoat[4]	
OIL-BASED	ALKYD FLAT	Unlimited	Excellent	Excellent	Flat	4-6 hours; recoat overnight	
OIL-BASED	GLOSS ENAMEL	Included in color systems, but deep colors tend to lose gloss	Best	Excellent[5]	Shiny	4-6 hours; recoat overnight	
OIL-BASED	SEMIGLOSS ENAMEL	Unlimited; deep colors take longer to harden	Good	Excellent[5]	Satiny	4-6 hours; recoat overnight	

[1]E, excellent; G, good; F, fair; NR, not recommended
[2]If dining room is open to kitchen and kitchen-type soiling is great, consider intermixture of compatible alkyd flat and semigloss
[3]If room is large and has an automatic ventilating fan to control moisture, regular wall paints may work—but ceilings should be gloss or semigloss

HOW TO PICK THE RIGHT

PS MATERIALS

Interior Paints

Planning to redecorate soon? The best coatings today for walls and trim aren't what they used to be

By Jackson Hand

HALF a generation ago, all paints had an objectionable odor and "use with adequate ventilation" meant that you had to open the windows wide. So, in those days, indoor painting usually was done in spring or summer. Today, new synthetic resins and odorless thinners—plus water-thinned paints that actually smell good—change the rules. Crack a window or two to drift off vapors—and go ahead and paint, any winter weekend you feel like it. Your heating plant speeds drying. You get a better job.

Interior paint has three jobs to do:

- Provide the color you want—and stay that color.
- Wash.
- Stay on when you put it on.

It's not hard to find a paint that will do

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Guide to Interior Paints

BEST PAINT FOR VARIOUS AREAS[1]

LIVING-ROOM WALLS	BEDROOM WALLS	DINING-ROOM WALLS[2]	ACTIVITY ROOMS	CEILINGS	KITCHEN	LAUNDRY[3]	BATHROOM[3]	BASEMENT	PANELING IN ANY ROOM	TRIM	PROBLEM WALLS
E	E	E	G	Special extra-flat paints are made by some manufacturers. They should not be used, however, in kitchens, baths, laundries, where gloss or semi-gloss enamels look right and are easy to keep clean	NR	NR	NR	E	F	See text. Regular wall paint is okay in some areas; others require the adhesion and water-resistance of gloss or semigloss enamels	In any situation where soiling is excessive and requires frequent or severe washing, use gloss enamel, which washes best
E	E	E	G		NR	NR	NR	E	F		
E	E	E	G		NR	NR	NR	E	F		
E	E	E	G		NR	NR	NR	NR	G		
NR	NR	NR	F		E-G	E	E	NR	F		
NR	E[6]	G	E		G-E	F	E	NR	E		

[4]Dark colors in these paints may take twice as long to dry. Do not wash these finishes until they have cured several days
[5]Best adhesion with enamels calls for proper primer
[6]For nursery or child's room

PAINT FOR THE JOB

these things. However, some types do certain jobs exceptionally well, and the difference in cost between the very best and the very worst is small.

Some places are harder on paint. There are areas in a house more demanding than others, and this is the critical factor in choosing a paint.

A living room offers the least challenge to a paint. The place is dry and there is little normal soiling. But move to the bathroom, where there is water plus moisture vapor plus soapy steam. Move to the kitchen, where there is moisture vapor plus oily vapor that must be washed off with detergents. Move to a child's bedroom or a family room with a fingerprint problem.

Things are different, too, area to area within a given room. Windows on the south and west may frost up, then melt and soak sash and sill over and over again. Walls over a fireplace may acquire smoke traces.

Pick a paint for its specialty. A woman was complaining to a paint dealer that she was going to have to tear out all the tile in her bathroom. It was the wrong color.

"Why not try this new epoxy enamel on it first?" he suggested. "If it doesn't work, *then* replace the tile."

She tried it. It worked, as smooth and glossy as tile itself. (Detail: She used a little wheeled striper to restore the appearance of grout between tiles.)

Washability. Gloss enamels, especially urethane and epoxy formulas, stand up under virtually unlimited washing for two

Now you can paint indoors all winter!

CONTINUED

Urheberrechtlich geschütztes Material

reasons. First, they are easy to wash and thus come clean without rough handling. Second, even under strong soaps, their film lasts and lasts. The ease with which they can be cleaned is increased even further by some recent formulations that contain silicones. These repel dirt—reduce its ability to stick to the surface. Good gloss enamels can be scoured, although in time the abrasives in scouring powders wear through the skin of the enamel. After that, washability decreases.

Semigloss enamels are next in durability under cleaning. Unless they need repeated scrubbing, they will last until you tire of them.

The so-called "alkyd flat enamels" are actually flat wall paints that act like enamels, and are the most washable of all wall paints. A problem in washing wall paints is that gradually the flatness burnishes to a semigloss—the reverse of what happens when you wash a gloss paint long enough to wear it down to semigloss.

The water-thinned wall paints wash fine except where soiling is so great or so frequent that you would not want to use a flat paint. Although there is some variation among manufacturers, the degree of washability goes from acrylic to polyvinyl acetate (PVA) to butadiene styrene.

Color and color retention. Since one of the problems with color purity is overcoming the color of the vehicle (usually yellowish) the best colors come from the clearest resins —generally acrylic and PVA. Although alkyds have been improved lately, some still tend to yellow with age. The best color retention lies, generally, with the water-thinned paints.

Color systems. You can get any paint in any color you want, literally. For practical reasons, however, there are limitations. The more pigment it takes to produce a color (a dark red, for instance), the higher the ratio of pigment to vehicle. This may affect washability, durability, drying time, and gloss. It frequently affects application, since a paint can become almost too pigment-filled to spread. Water-thinned paints tend to tolerate the extra pigment better than alkyds.

Are factory-mixed paints better than custom colors mixed in the store? Experts say they generally are: Formulations don't vary, and big-batch production means perfect intermixing. If you can get yourself to like an off-the-shelf color, you're wise.

Flatness. If flatness is the prime consideration, you get it best from alkyd flats and from acrylic wall paints. Flatness results from a nonsheen base plus fairly coarse-ground pigments. These break up the surface into millions of tiny textured hills and valleys, from which light bounces less. Since all flat paint tends to turn toward glossy with washing, never use any flat paint where frequent or rigorous washing is necessary.

Adhesion. Alkyd enamels and alkyd flats stick to the surface they are brushed on. Adhesion is rarely important on walls and ceilings; it is very important on trim. You can bet there will be paint-adhesion failure around windows and doors in any house you care to examine. The cause: water under the paint.

Adhesion is a system, not just a paint. You need the proper primer, which will stick to the wood. Then you can follow it with the color and the degree of sheen you want in a top coat that will stick to the primer.

Matching wall and trim color. There is no reason why you can't use alkyd and water-thinned wall paints on trim whenever you want trim and walls the same color. Exceptions: where there is much soiling; where there may be almost an outdoor degree of exposure, as around doors and windows; where window sills may be used as shelves.

Many home owners paint window frames, door frames, baseboards, perhaps crown moldings, with the wall paint. They buy matching enamel for sash, for doors, for hardware. This way, the difference between wall and trim is nil. The matching enamel —especially semigloss—barely looks different even on doors and windows.

Painting cracked walls. In older houses, walls and ceilings may be rough, uneven, or cracked. Two standard techniques will camouflage them.

The first—and oldest—is stippling. Although special paints are sold under the name of "stippling flat," almost any oil-base paint will work. Brush or roll on the paint and let it partially dry—but not too long. Then dab it with a special stippling brush.

The second is sand paint. The best way is to buy a small bag of "sand"—such as Ad-Mix (actually, granular perlite or polystyrene beads). Stir it into any paint and it stays in suspension, giving the finished paint a gritty, textured, blemish-hiding surface. Put sand in the first coat only. ■ ■

Urheberrecht ch geschützes Mate al

You can build this

Shop Vacuum for Less Than $10

By John Copeland

A SHOP vacuum is a luxury most of us dream of owning but usually put off buying because of the cost. This needn't be. With the motor and blower from an old household vacuum cleaner plus a big drum, you can make your own shop vac for peanuts.

The one shown here, built and tested especially for PS, cost only $6.70 for parts. Even if you spend several dollars for the motor, you can still put the whole works together for less than $10.

It's efficient, too. Connected

Old upright vacuum cleaner and a discarded 16-gallon oil drum team up to make this big-capacity shop vacuum for only a few dollars. The vacuum rolls on wheels (not visible here), can be moved from tool to tool as needed. Here, its hose is plugged into a special dust-collector hood made for use with a radial-arm saw.

What the parts cost

Old upright cleaner	$1.00
Dust-filter bag	.95
6' defroster hose	2.40
16-gal. oil drum	.70
Eyebolts	.40
Brackets	.30
Hose clamps	.70
¼" hardware cloth	.25
Total	$6.70

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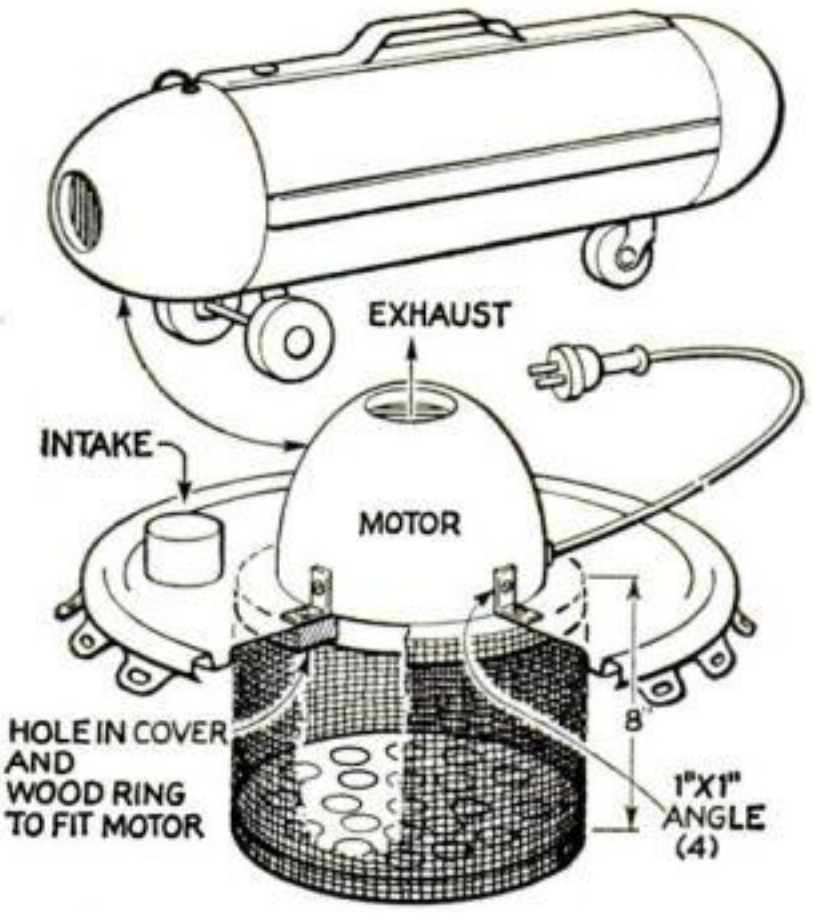


You can also use a tank-type vacuum

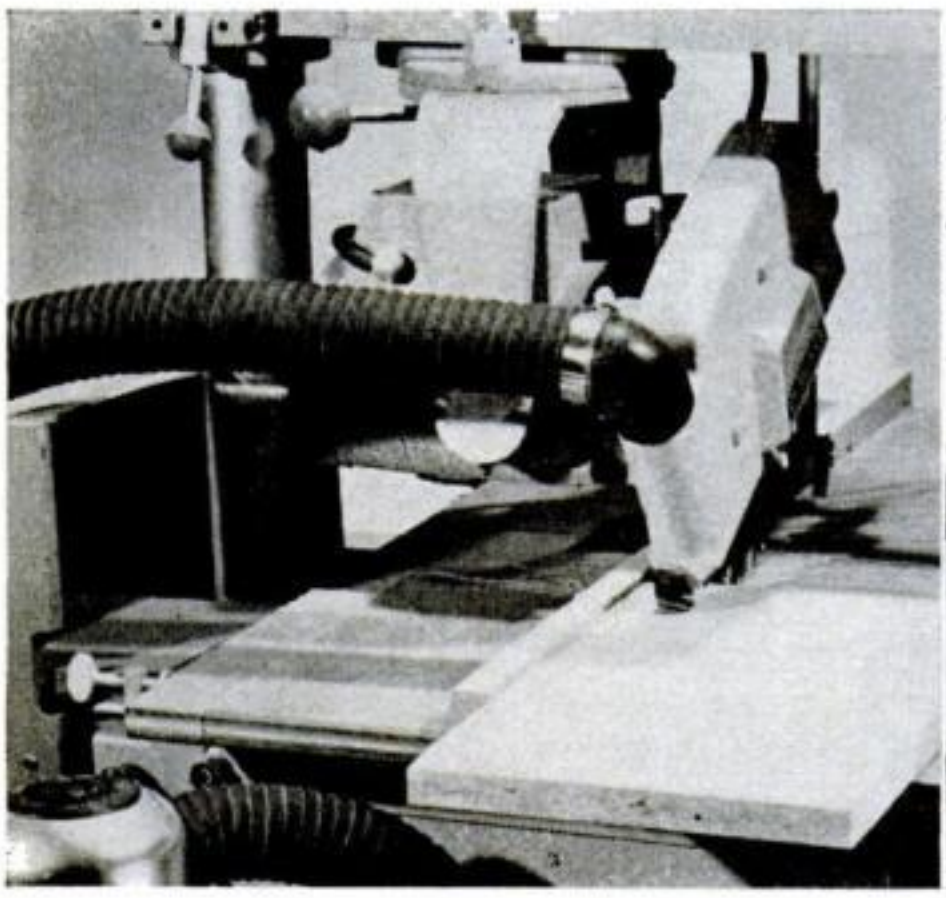
If you have or can buy an old tank-type vacuum cleaner, the mounting job is even easier than with an upright cleaner. Just remove the motor end and mount it in a matching hole in the drum's lid. Since the exhaust is directly out through the motor housing, there's no need to make a separate exhaust chamber. The motor is held between a wood clamp ring under the lid and angle brackets on top, as shown above. The blower cage and other parts are the same as for the upright-cleaner version.

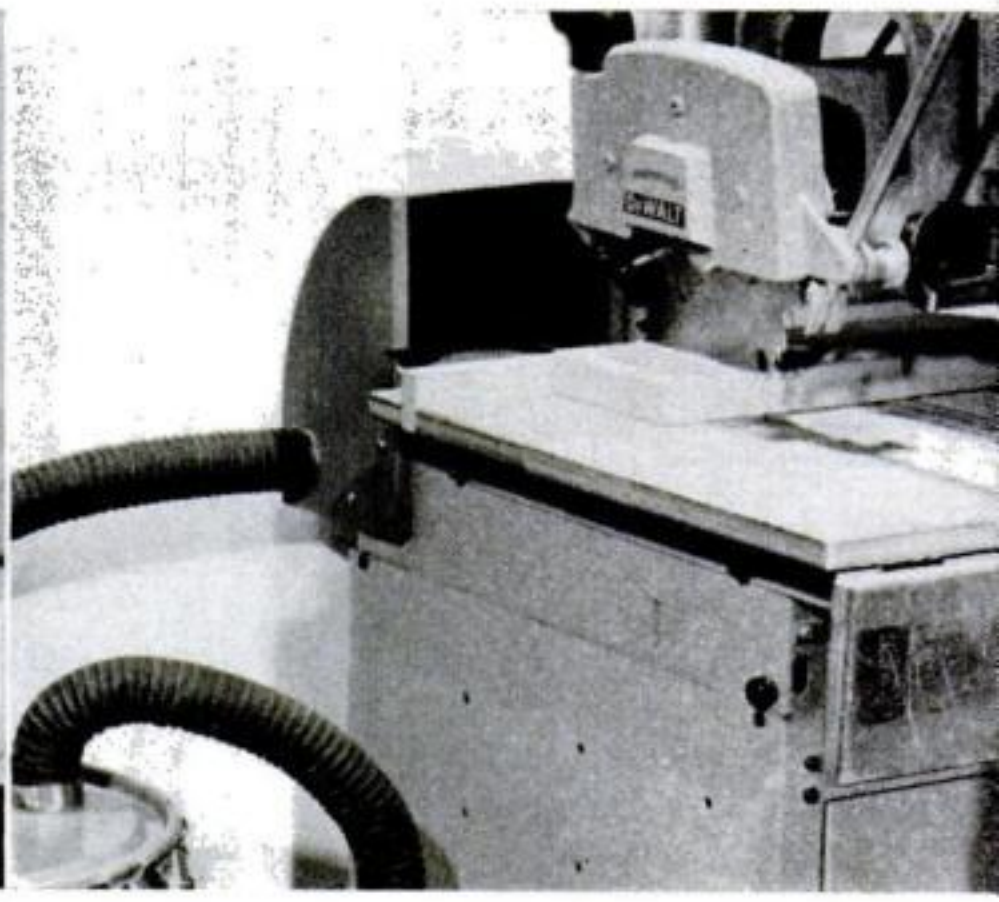
to a properly designed collector hood it will swallow 90 percent of the dust from a radial saw—a prodigious dust maker. Mounted on wheels, it can be rolled to other tools, such as a power sander.

The blower creates a partial vacuum inside the drum, and sawdust is drawn in through a hose attached to the lid. Discarded 16-gallon grease or oil drums can be picked up at auto-service stations, often free. Junked cleaners can be found at appliance-service shops. The 2″ hose, the type sold for car defrosters, is available at auto-parts stores.

If you use an upright-cleaner motor, you'll need to build a chamber to direct the exhaust outside. An alternate version, using a tank-type cleaner, is also shown. This requires no exhaust chamber. In either case, a wire cage is mounted below the blower to form a shroud. This is covered with a cloth filter bag—the kind sold for commercial shop vacs. The bags are available from Sears, Roebuck and other outlets where commercial vacs are sold.

The collector hood shown here was designed to increase the vac's efficiency with my radial saw. Minor changes will be needed to suit it to different makes of saws. However, the curve at the rear is critical. Follow it closely. It was worked out to give just the right downward deflection to put the dust into the lower trap where it can't bounce out.





Two types of dust pickup are possible on a radial saw. When saw is in rip position, the vacuum's hose can be hooked to the regular discharge port on the blade guard, as at left. In crosscut position, dust pickup is more efficient with a special collector hood mounted behind the blade, as at right. How collector is made is shown on the facing page.

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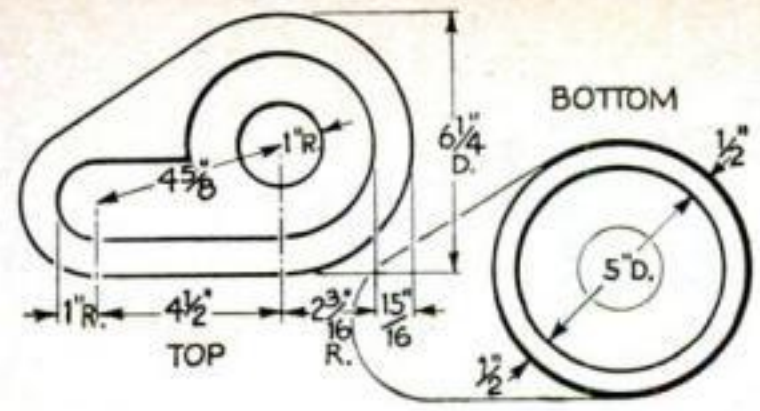
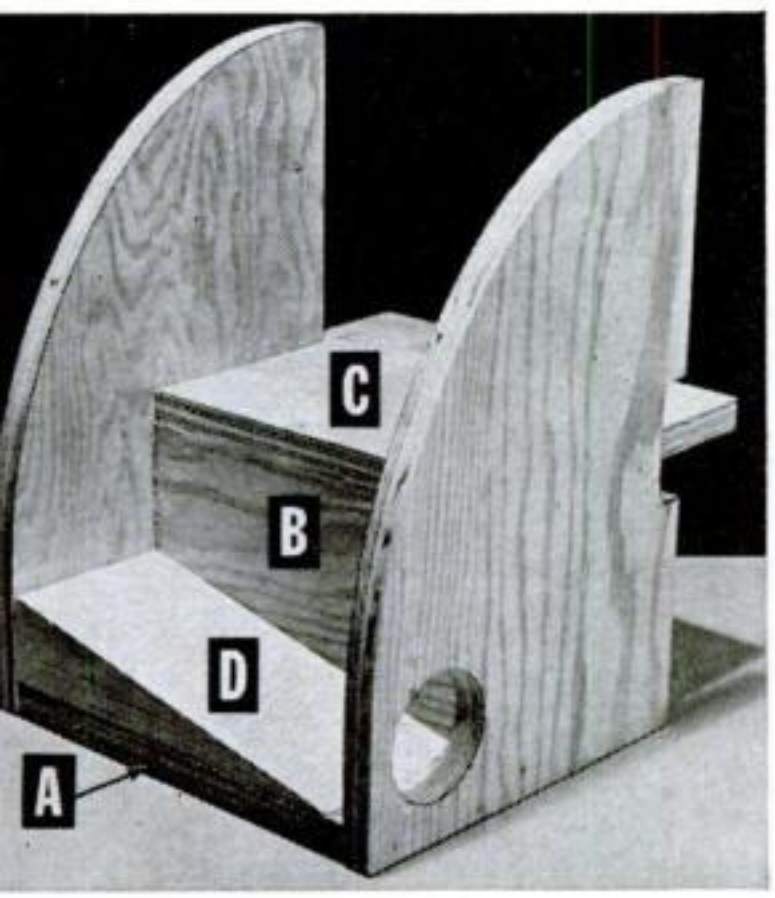
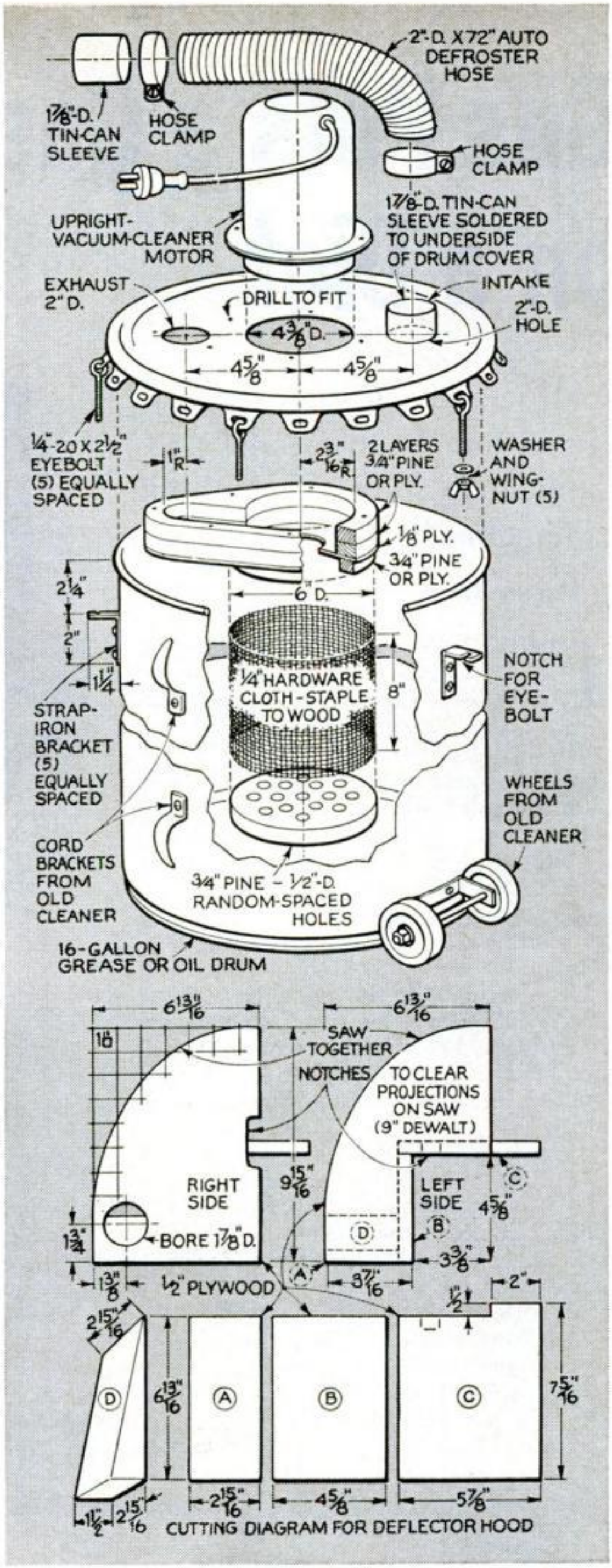


Exhaust chamber is designed to channel blower's discharge air out a port in the lid. Chamber's large end can be sized to fit the particular vacuum motor you use.

Cloth filter bag slips over the wire-mesh blower cage to keep sawdust out of the motor. Bag is standard 6"-diameter type sold for commercial shop vacuums.



Rear curve on dust collector is critical. Lay it out carefully on squares, as at right. Ramp at bottom helps direct dust toward the hose connection. ■ ■



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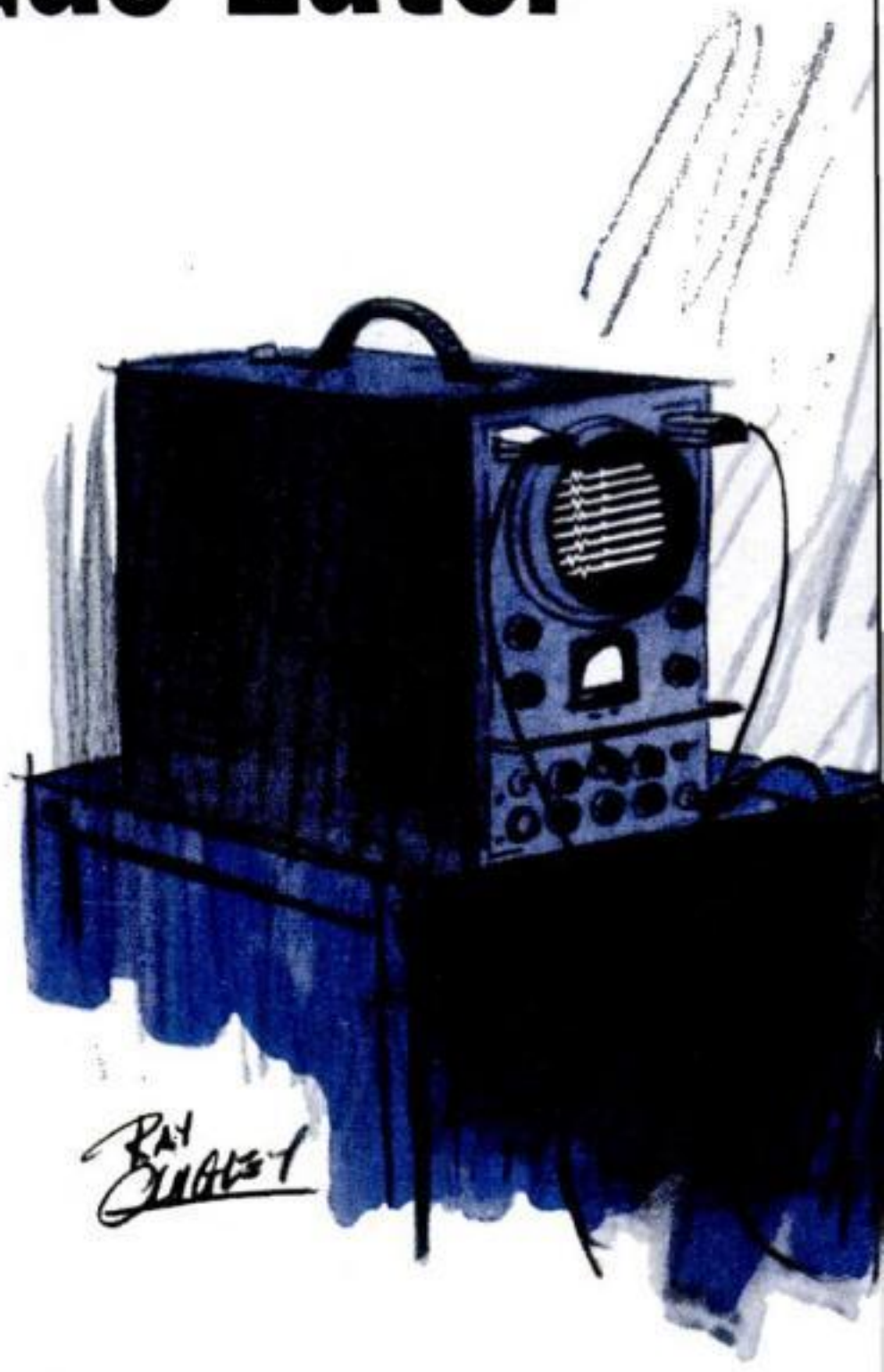
Gus Puts a Gas Eater on a Diet



With scientific gadgets—and a lucky hunch—the Model Garageman solves a couple of baffling mechanical mysteries

By Martin Bunn

THE '63 Chevrolet pulled in at the Model Garage and the driver grinned proudly as Gus Wilson came out to the gas pumps.

"Hi, Gus. What do you think of it?" asked the young man behind the wheel. "Sure beats the old bus I started with."

"Sure does," Gus agreed. "Had it long?"

"Only just drove it off Brenton's used-car lot. Fill it up, will you?"

Gus started the hose running and wiped the windshield. "How's the sales route?"

"Coming along. Got enough customers to break even. With this car to cover more territory, I'll get a lot more, sure as my name's Tim Foley. The payments will come hard at first, but the old crate broke down twice, and that could lose me customers."

"How far do you drive every day?"

"Oh, 200 miles or so. This looks and feels like a low-mileage car—though I wouldn't swear to the 10,000 miles on the clock. It's a six with stick shift, so it ought to be easy on gas. Got a good buy. Brenton cut the price for a quick turnover."

"Good luck with it, Tim," Gus said as Foley handed over the price of the gas.

Foley winked slowly, his good-looking Irish face one vast grin as he drove out.

Wheels crunched over a thin snow crust as a convertible with dealer's plates rolled up. Gus raised the big garage door. The car moved in and Ed Stern stepped out.

"Hello, Gus." The newcomer jerked a thumb toward the street. "I see Brenton's sold it again."

"Tim Foley's new car? You know him?"

"Not him—the car. I sold it twice myself when I was selling for Brenton's."

"Sounds like a lemon," muttered Gus. "Think it'll let Foley down on the road?"

"Oh, no. It runs real good. That's not what's wrong with it. What's Foley do?"

"Covers an upstate sales route. He drives about 1,000 miles a week."

Stern whistled. "Well, that's his worry. Mine's a high-speed miss. I work over in Wayville now, but my customer lives here, and I promised him this convertible today.

"The engine's been retimed, has new points, a new condenser, and new plugs. But floor it on a hill or to pass, and engine performance falls off enough to notice—and

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"Looks like something out of a science-fiction TV," commented Stern. "But makes more sense," said Gus.

this customer will. Our shop's so busy I guess the boys didn't road-test it. The miss only showed up as I was driving here. If I take it back to our shop, I'll lose a lot of time. Can you help me out?"

"Glad to try," said Gus, raising the hood. "I'll hook on an ignition scope."

He rolled over a wheeled case on which stood a louvered box that looked something like a TV set with a tube face on its front. Clipping one lead over the cable of the No. 1 plug, Gus clipped another on the coil lead to the distributor and switched on the unit.

"Want to start it up, Ed?"

The starter groaned briefly. As the tube face blossomed into phosphorescence, eight parallel white bars spread horizontally across it. Each began as a short straight line, broke into a multitoothed zigzag of about the same length, and continued as a straight line with a secondary, smaller squiggle one fourth of the way along it.

"Looks like something out of a science-fiction TV drama." commented Stern.

"But makes a lot more sense," said Gus. "Each tracer shows ignition events in one cylinder. The short line is spark duration at the plug. The big oscillation shows the discharge, through the condenser, of energy left in the coil after the spark stops. That smaller squiggle starts when the points close. The long line beyond it is cam dwell, while the points are closed."

"For all eight cylinders?" protested Stern. "You're only hooked up to one."

Gus grinned. "Black-box magic, and it sure works. There's your trouble—No. 7 plug. Its spark line's shorter and lower than the others, meaning it takes a higher voltage to jump that plug, and the spark

CONTINUED

Urheberrechtlich geschütztes Material

doesn't last as long as the others. That leaves more energy in the coil, so the condenser oscillations are bigger. In other words, the plug has high resistance."

Ed Stern scratched his jaw. "But I saw them put in new plugs. Maybe that one's defective. Will you yank it out?"

The questionable plug was in an awkward position, and removing it took far longer than spotting it on the scope. When Gus finally had it out, it proved to be old and dirty, its insulator browned by heat.

"Now, why'd they leave that one in?" muttered Stern. "All the others are new."

"You saw how hard it was to pull it," returned Gus. "Your mechanic put in seven new plugs and skipped this one, hoping any difference would never be noticed in a V-8. Probably wouldn't have been, if this plug had been firing right. But the gap is wide and it's an off-brand resistor plug whose resistance may have gone way up, as unstable resistors in cheap plugs do."

"I'd never buy bargain plugs myself."

"It can happen to good resistor plugs, too, if they run hot," said Gus. "Too much heat or voltage can boost their resistance far over the normal 10,000 ohms."

"Well, put in a new one. Then I can deliver this car without expecting a beef. Which is more than Brenton can say," added Stern darkly, "for the one he sold Foley."

On Thursday, Tim Foley again stopped for gas at the Model Garage pumps.

"How's it running?" asked Gus.

"Oh, swell." For a moment it seemed the young Irishman was about to say more. Instead, he clamped his jaw shut and drove off without the smile Gus expected.

But that Saturday he drove into the shop in midmorning, his face grim and a muscle twitching alongside his jaw.

"Got a problem, Gus," he said harshly. "Get 10 miles to the gallon. Ten, with a six-barrel engine and stick shift. It should be 20! With the car payments, I just can't afford that kind of gas bill.

"I had the car back to Brenton's twice this week. First they adjusted something, but it made no difference. Then they offered to put in new plugs—if I'd pay for them! This morning Brenton offered to take the car in on any other on the lot—for 200 less than I paid!"

Gus slowly punched tobacco into his pipe. "Mind saying what you did pay?"

Foley told him. The figure was surprisingly low. "It sure looked like a buy. But a lemon's sour at any price."

Nodding, Gus put away the unlit pipe.

"To save time," he said, "I'm going to get a little information. Relax, Tim."

In his office, Gus dialed the Wayville agency where Ed Stern worked.

"I've got that Chevrolet of Foley's in the shop, Ed," he told the car salesman. "What's the story on it?"

Stern hesitated. "Nothing I can tell you will help you fix that gas hog, Gus."

"You mean it's always been one?"

"The boys at the agency say it was a hard-luck car from the start. The first buyer stalled on the thruway a week after he bought it. Dirt in the gasoline. A mechanic cleaned the car on the spot. It ran okay then, but it was back in the shop every week on a complaint of poor gas mileage. They tried every fix in the manual and a lot that weren't. The owner finally sold it in disgust when his warranty expired.

"Actually, Brenton's made a good thing of that car. He sells it cheap. Every time a buyer squawks, he winds up trading it for another Brenton car and taking a loss on the trade-in. Foley better swap it back, too—every other dealer around knows that crate by now, and he'll do better at Brenton's than anywhere else. Brenton enjoys trading that car."

Pushbutton streetcar

Conductors on trolley cars in Zurich, Switzerland, have been replaced by a pushbutton. Self-service doors are opened by the passenger when the motorman stops at the corner.

Travel on the cars is reserved exclusively for those holding commutation tickets. Anyone caught trying to ride free faces a fine of five Swiss francs.

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Who's got everything for your Ford from...

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to Windshield Washers

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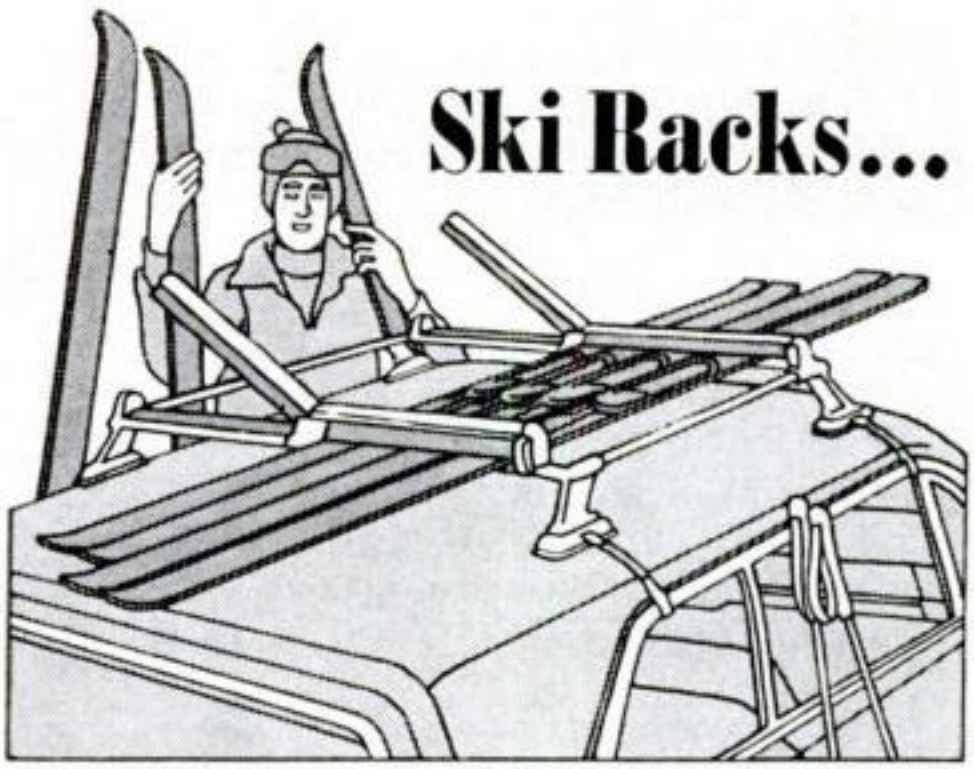
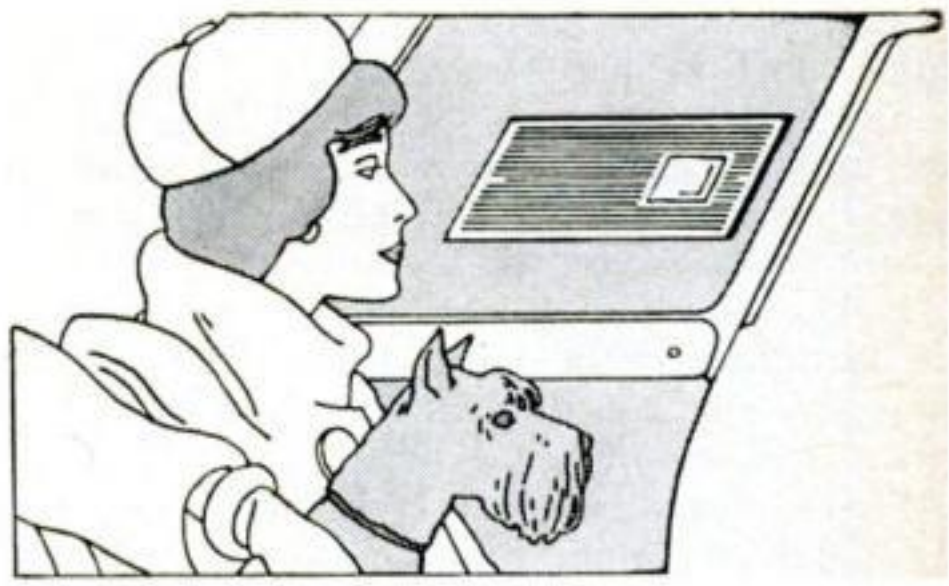
Ski Racks...



Pick from roof or deck-mounted models with chromed-steel frames and rubber guards to protect paint. Have locks to guard against theft. From $44.50*.



to Sound Systems

Give your car's radio system concert hall quality with Ford's StudioSonic Sound System. Speaker or speakers mounted in rear of car give stereo effect. $22.95*—speakers from $11.95*.

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You'll get the most for your driving pleasure from your Ford Dealer.

*Manufacturer's suggested retail prices. Installation charges, state and local taxes, if any, are extra.

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Thoughtfully, Gus hung up and went back to the shop floor.

Foley spun around. "Find out anything?"

"Only that you've got lots of company," muttered Gus. "But let's see . . . "

There was no smell of gas or trace of leakage around the carburetor. Gus started the engine, watching for any sign of seepage from the fuel pump, gas line, or carburetor bowl. None showed. Besides, if the trouble were a leaky float, bad float valve, or clogged bowl vent, any one of those would have caused flooding, stalling, and hard hot starts.

Killing the engine, Gus detached the air filter. A clogged filter could restrict air flow to the point where you'd get a chronically rich mixture. He took out the filter element. It wasn't clogged.

Gus put the filter together again but, instead of replacing it, stared thoughtfully at the carburetor. This model had a power piston to furnish extra gas on heavy load or acceleration. It was possible . . .

He detached the gas line and vacuum line, loosened the carburetor, and carefully lifted it off. The gasket tried to come with it. Gently he pried it loose all around, until it fell back on the manifold. Then he looked at the underside of the carburetor from which he had loosened it.

Setting the carburetor down, he lifted off the gasket itself and examined it for damage. It was still in good condition. He put it back and lowered the carburetor onto it.

"Okay. Your trouble is gone," said Gus as he tightened the nuts. He reconnected the gas line, set the air cleaner back in place, and grinned at Foley.

"Let's check before I crow any more," he suggested. "Stan! Roll the exhaust analyzer over here."

Gus had the engine going before Stan could install the pickup unit in the tailpipe.

Soon Gus pointed to the instrument.

Its needle indicated *lean.* "That says decent gas mileage from now on, Tim."

"But what'd you do?" asked Foley. "All I saw you do was take off the air cleaner and carburetor, and put 'em back"

"I took off the gasket, too."

"Well, sure. But what did that do?"

"Fixed the trouble," said Gus. "That gasket was installed backwards. The vacuum passage to the power piston on the carburetor didn't line up with the hole in the gasket. It was on the other side, so the passage and the piston were blocked off from the manifold."

Foley shook his head. "Don't get any of it, Gus. What's a power piston?"

"An automatic control to feed more gas when the engine needs it most. When you open the throttle, manifold vacuum drops. As it falls below about 10 inches of mercury, the lowered pressure lets a spring-loaded piston move. This opens a supplementary fuel jet, which feeds extra gas into the venturi to give you more power in a hurry.

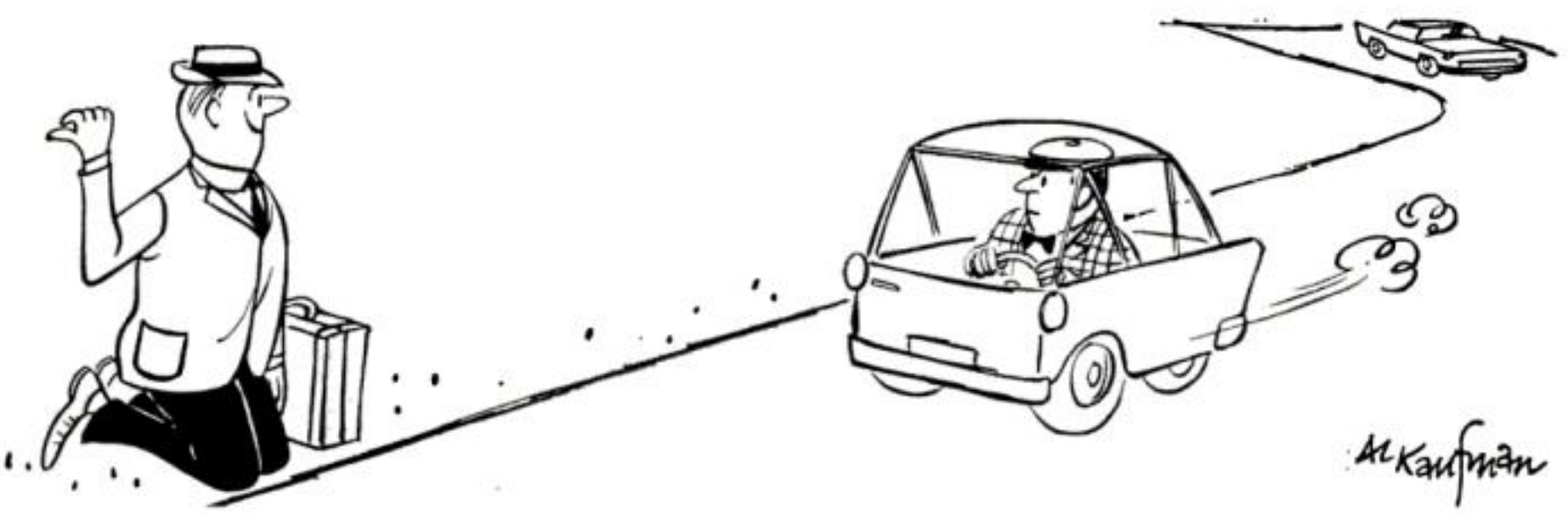
"With the gasket turned around, all manifold vacuum was blocked off. The spring held the piston and fuel jet in the open position constantly. You ran on a super-rich mixture all the time. No wonder the car gulped gas. When I put back the gasket, I flipped it over. The hole registers with the vacuum passage, supplementary fuel will feed only when needed, and your gas mileage should be normal."

Tim Foley sighed. "Begorra, as my grandfather would say, that time I got it! But how you thought of it I'll never know."

"Part of the luck of the Irish, Tim."

"Mine? You mean I'm the lucky one?"

"Sure. Who else," asked Gus, "would get such a good buy in a car—just because some mechanic goofed?" ■■



Irresistible model shown, '65 Chevrolet Impala Sport Coupe

Irresistible force—in an irresistible object

'65 CHEVROLET 409

Order a Chevrolet and ponder some irresistible choices too.

Like our 409-cubic-inch V8 which we'll tuck under any '65 Chevrolet at your request.

For '65, you can order the 409 in two powerful forms: 340 hp (4-barrel carburetor, hydraulic lifters, 10.0:1 compression ratio) and 400 hp (aluminum 4-barrel mechanical lifters, 11.0:1 compression ratio). Both have a larger, more durable clutch. And you can specify Delcotronic full-transistor ignition for either.

The 409 makes the switch to the bigger, heftier '65 Chevrolet like it was born there. Leaving you with one problem — deciding which Chevrolet to put it in.

Don't you wish you had more problems like that?

CHEVROLET

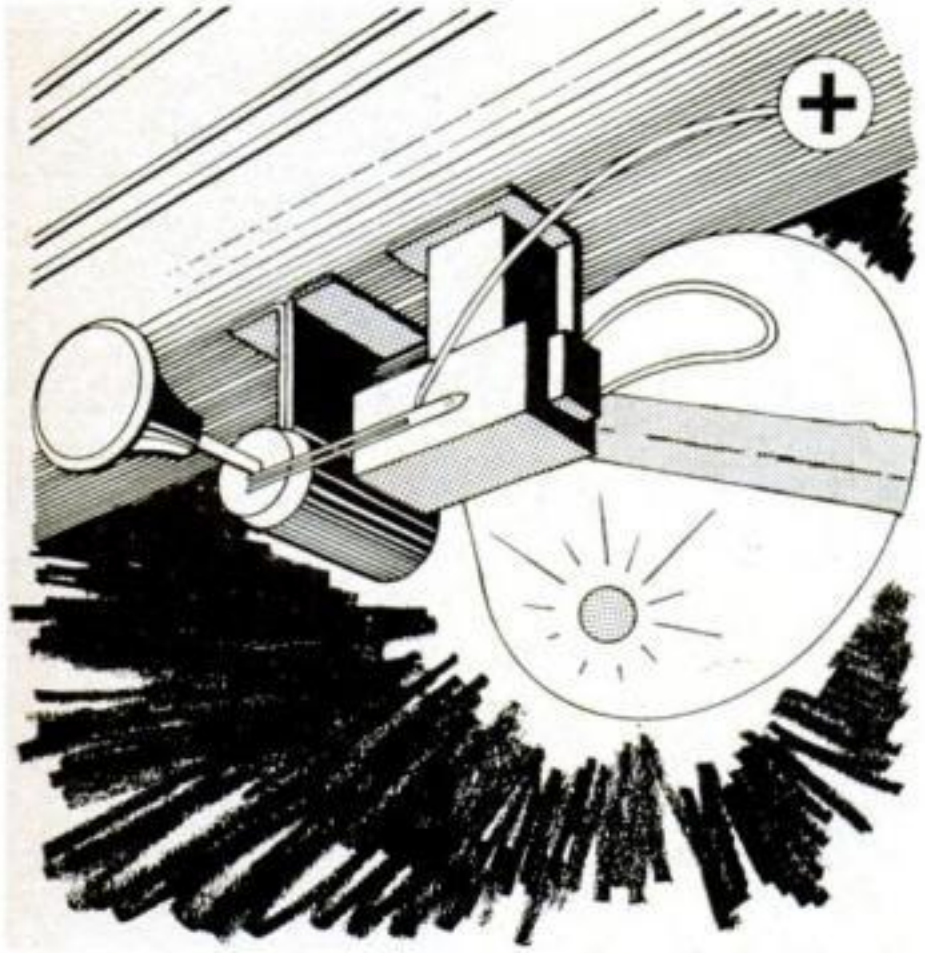
Chevrolet Division of General Motors, Detroit, Michigan

171

Urheberrechtlich geschütztes Material

Hints from the Model Garage

Washing winter grime off your car in cold weather can leave you with a set of frozen locks if you park your car out of doors. Avoid the problem by taping over the locks with masking or adhesive tape—and be sure not to forget that trunk lock.



Keep forgetting to push the choke knob back after the engine warms up? A warning light is an ideal answer. It can be made from a low-cost clamp-on running lamp and a mercury switch. Wire the lamp and switch in series to the accessory terminal of the ignition switch. Make a shade for the bulb by taping a white card into a cone, with red cellophane covering a hole.

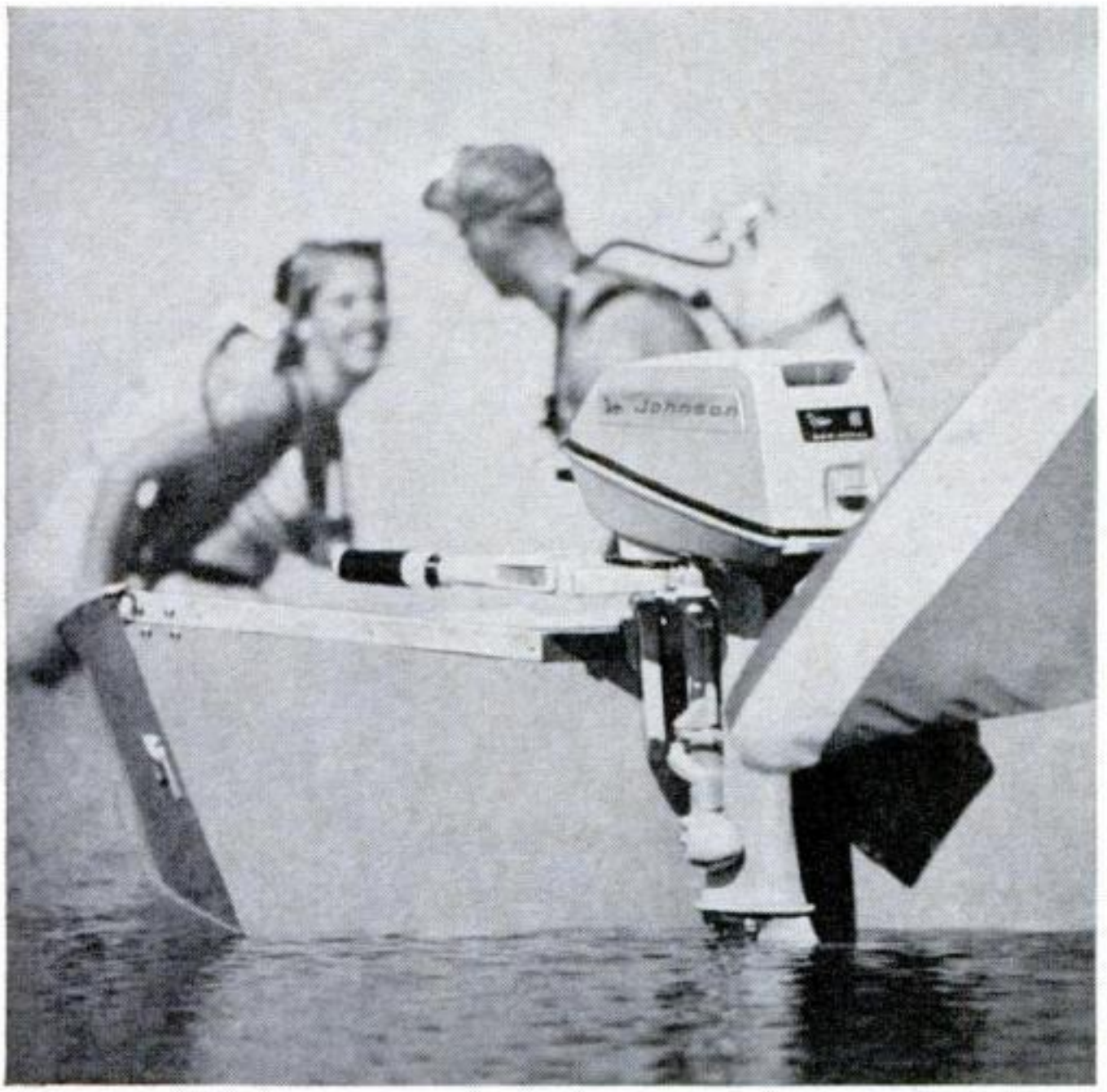
To prevent kinks from forming at sharp bends in radiator or heater hoses, place a worm-drive type of hose clamp at the middle of the bend. Tightening the clamp until it grips firmly will force the hose into a correct cross section and permit the full flow of coolant. In addition, the hose is less likely to leak when there are no kinks in it to weaken the rubber.

CONTINUED

Urheberrechtlich geschütztes Material

Searching for an ultra-compact outboard with many "big motor" features...one good for fishing or fish-watching and that carries a 2-year warranty?

This luxury lightweight is it!
The carefree, new 6 (a Sea-Horse, of course!)



This new Johnson 6 is the latest and most distinguished descendant of the first truly quiet outboard. Compared with last year's 5½ hp it is lower, lighter, lustier. The all-new styling reduces powerhead height 1½ inches, reduces weight 6 pounds. Increased compression and a change in carburetion deliver the added zing.

The complete angler's complete outboard. Every big-motor feature that can be of use on a motor of this size is "built in" to the 6. Full gear-shift, twist-grip throttle, fixed high speed carburetor jets, full range silencing and more.

17 new models in 10 power classes. From 3 to 90 hp, not one requires special marine gas or oil. As an additional saving, all use Johnson's new 50 to 1 gas-oil mix which halves oil costs and ups spark plug life 50%. What's more, all are fully corrosion-resistant and are backed by a 2-year warranty* good for parts and labor.

For the right engine to fit your needs, see your Johnson dealer. He's in the Yellow Pages. Johnson Motors, 1943 Pershing Rd., Waukegan, Ill. Div. Outboard Marine Corp. In Canada: Johnson Motors, Peterborough, Ontario.

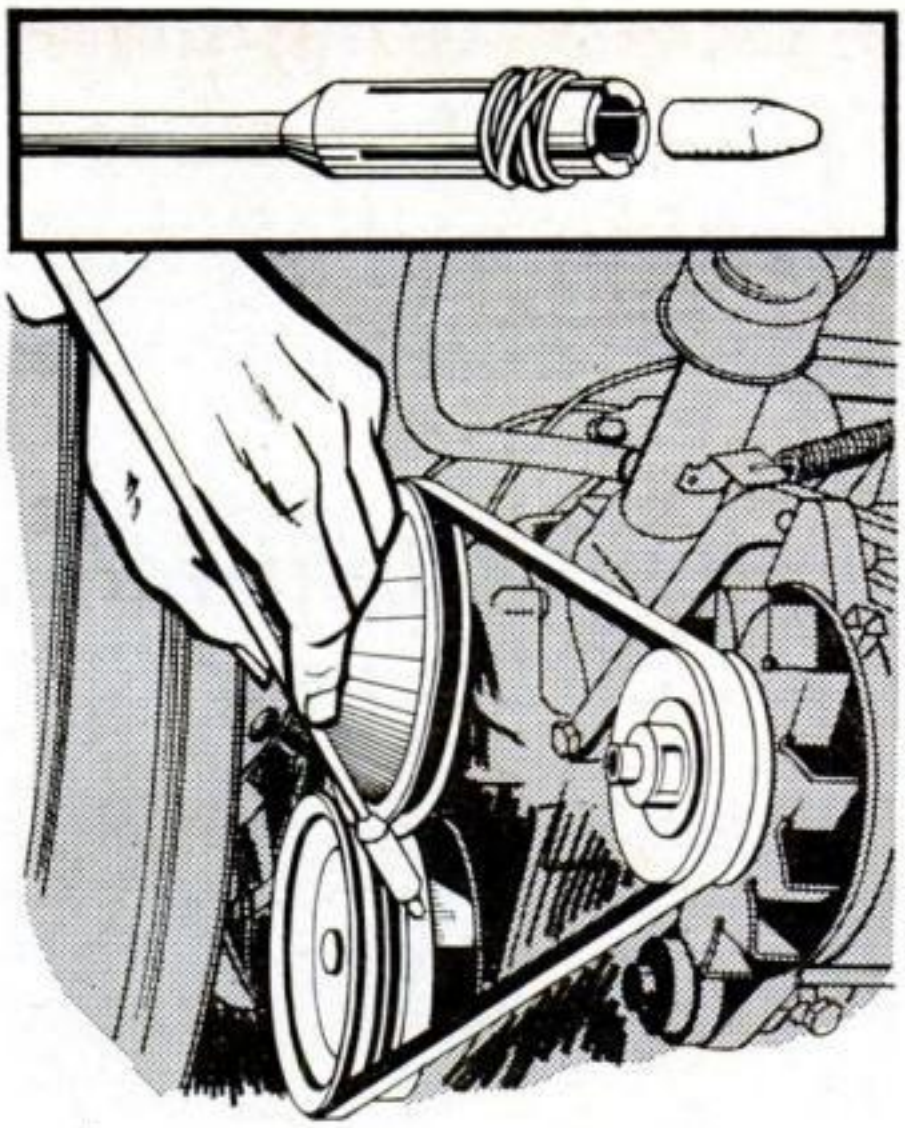
*For 24 months after purchase, Johnson Motors will replace, without cost to the original purchaser, any part of its manufacture which upon inspection proves to have failed in normal use due to faulty material or workmanship.

Another carefree Johnson ...first in dependability

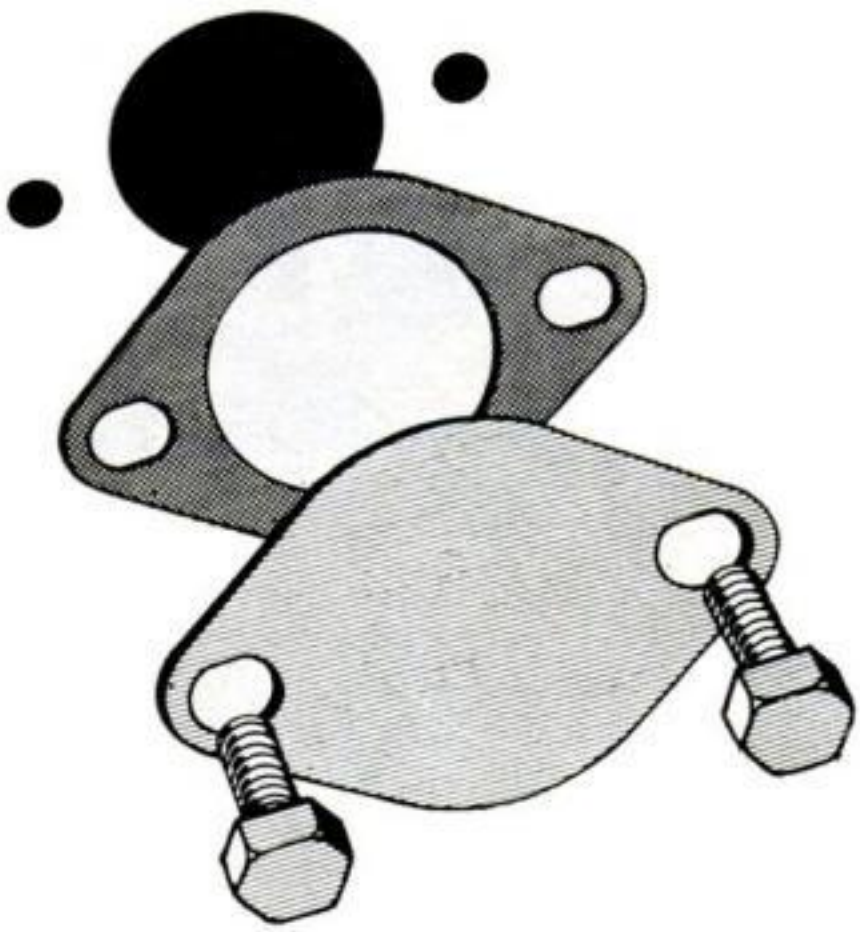
Urheberrechtlich geschütztes Material

More Hints from the Model Garage

If you don't smoke, your ashtray can be converted into a handy holder for toll coins. Just cut off the snuffer at the tray front with a hacksaw, and insert a ½″ spring, slightly longer than the tray is wide, across it to hold six or eight small coins.



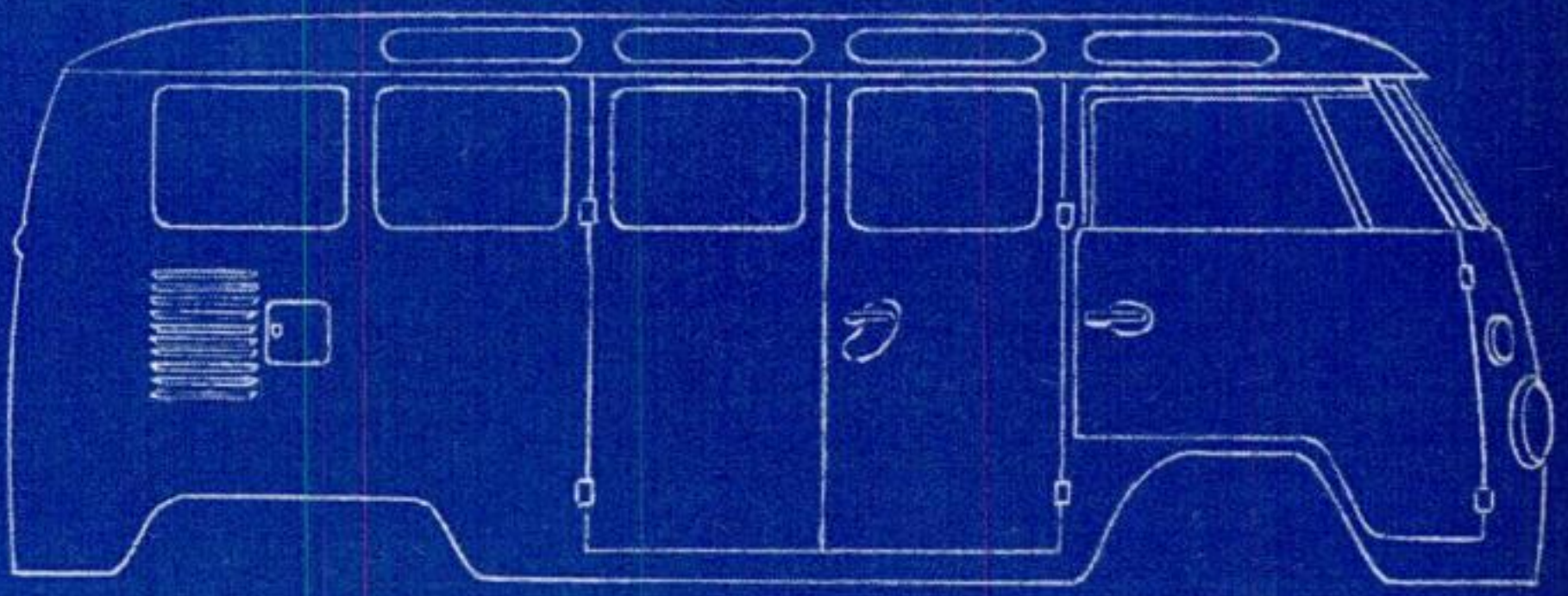
Chalking those hard-to-reach marks on the crankshaft pulley and index pointer can be a lot easier with a chalk holder made from a discarded radio antenna. Cut 2″ slots in the hollow tube and flare it to fit the chalk. Rubber bands hold it tight.



Repair of leaky freeze plugs is easier, on cars like the '55 Pontiac that have interchangeable cylinder heads, if you block off the leaky plug. Use gasket at front water outlet as template to cut a steel plate, install gasket, secure plate with cap screws.

Keep sand handy for winter emergencies when wheels spin in snow or on ice by packing it in plastic food bags. Most bags hold just about enough for one-shot use under the wheels to get you going. You can tuck 10 or 12 of these in the trunk.

Urheberrechtlich geschütztes Material



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It all began with the notion that a wagon should hold a lot, and no notion about how it should look.

So when we sat down to design the VW Station Wagon we started by drawing a big box with 170 cubic feet of space.

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This gave us room to seat 9 people comfortably and 13 pieces of luggage.

(13 bags more than you could ever fit into most wagons that hold 9 people.)

Once we got the people in we couldn't just let them sit there in a dark box.

So we cut 21 windows to let the light in, a big hole in the back to put the luggage in, and 4 doors to let the people out.

To make the thing go, we put the air-cooled Volkswagen engine in back.

And what we ended up with is what you see in the picture.

A sensible wagon that holds a lot, parks in little spots and doesn't drink much gasoline.

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Wordless Workshop

By Roy Doty

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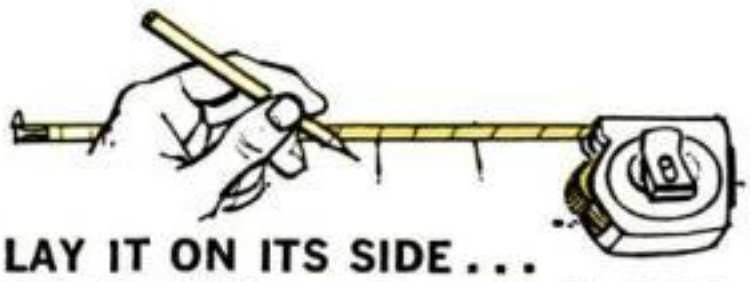

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*DuPont Trademark for its polyester film

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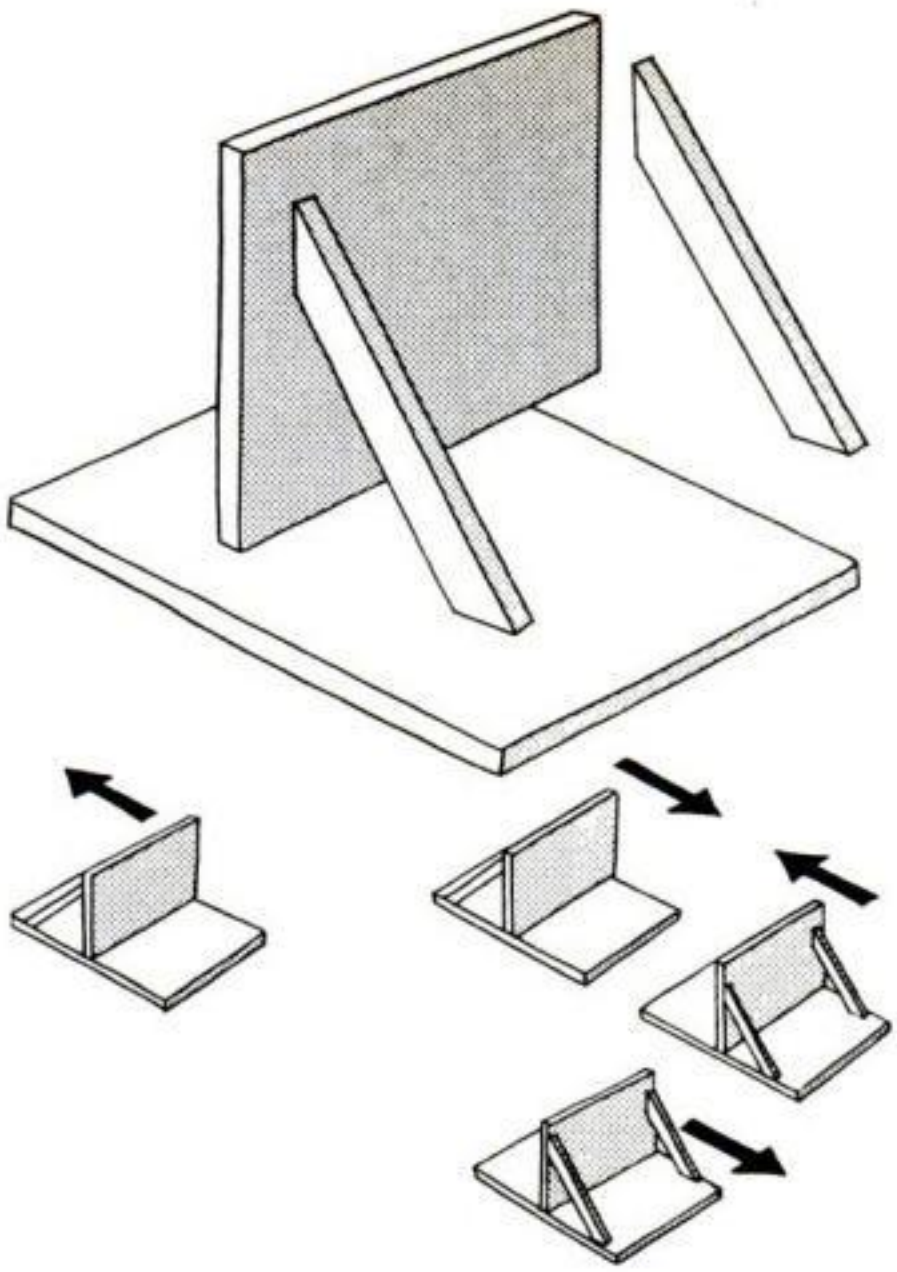

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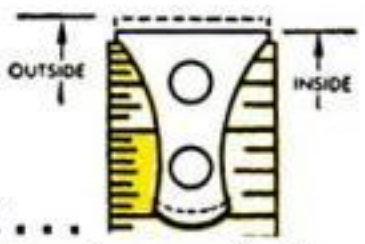

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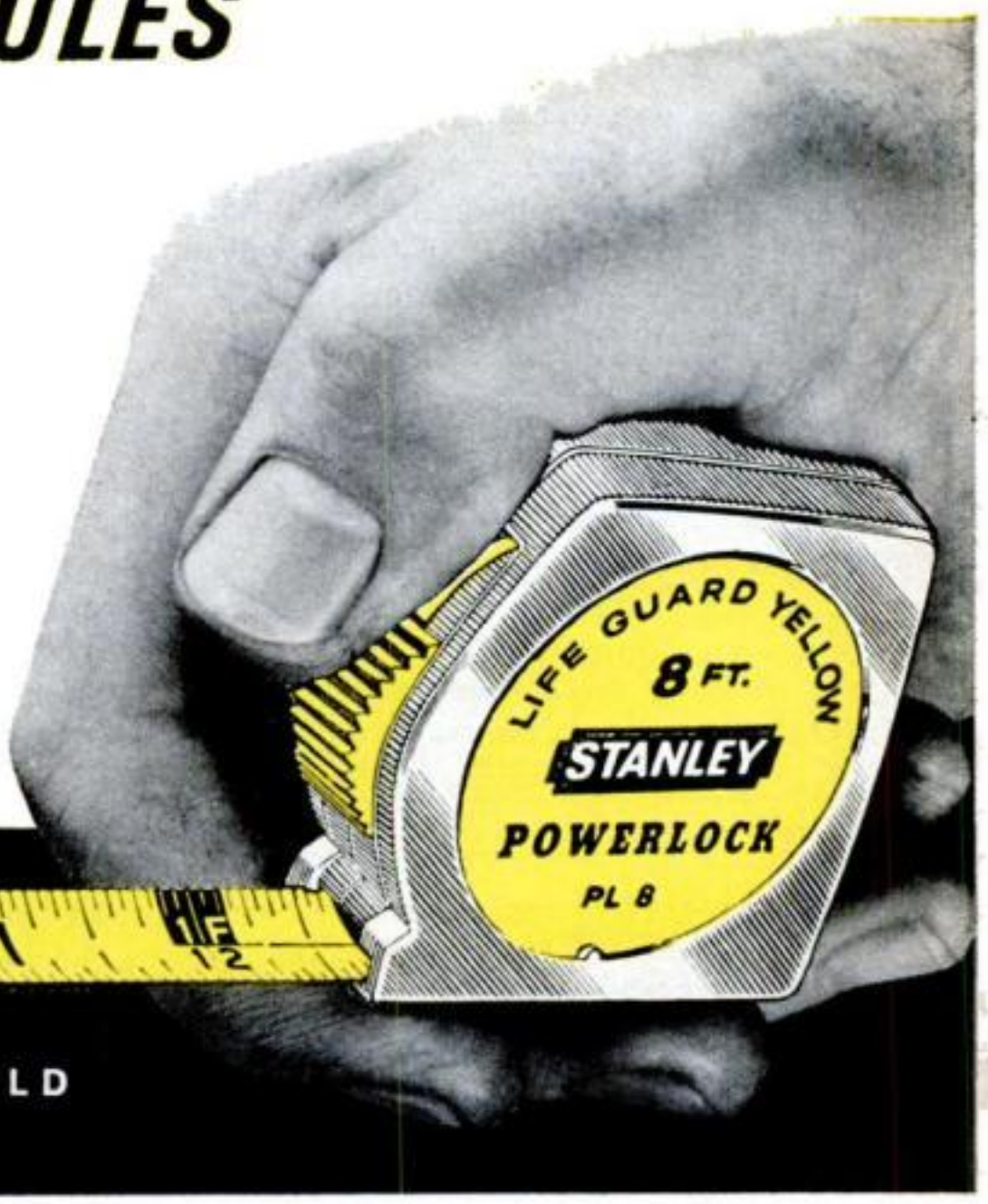

THE TOOL BOX OF THE WORLD

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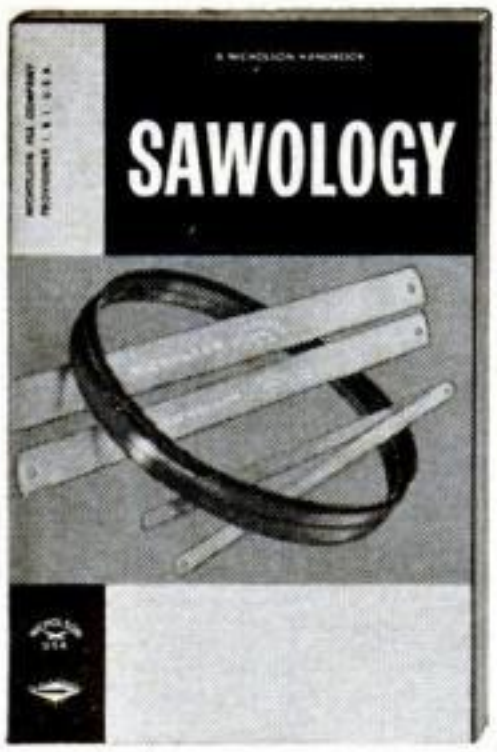

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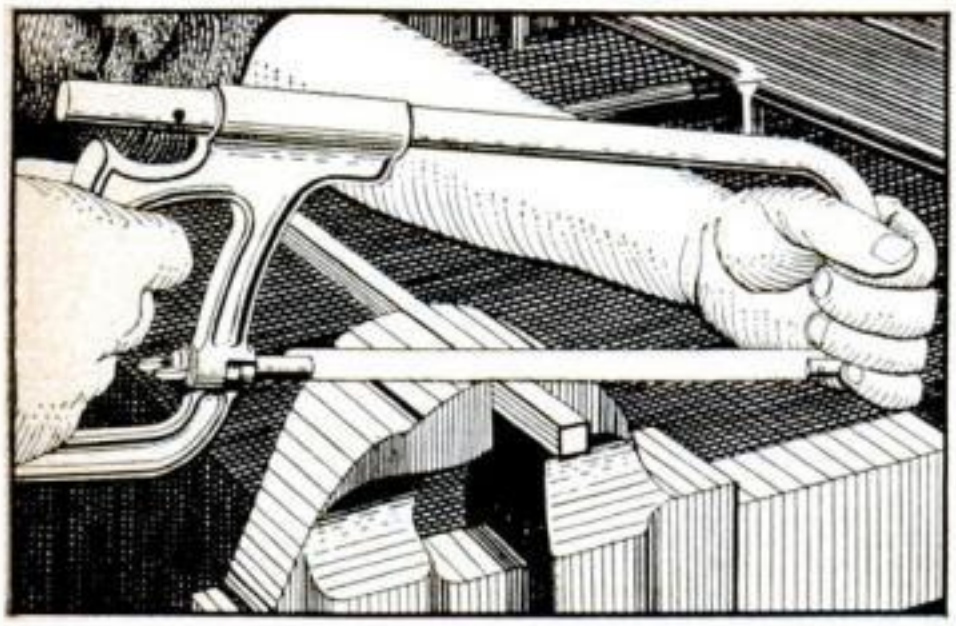

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Why and How of the Countdown

[Continued from page 67]

an unmanned, instrument-filled mockup of the Apollo spacecraft—had been flown in from the Los Angeles plant of the manufacturer, North American Aviation, Inc. Additional parts had come from NASA's Manned Spacecraft Center in Houston.

After a receiving inspection, a few days' hangar delay for "updating" (substitution of improved parts arriving belatedly by special messenger), and further checkout of "individual" and "integrated" systems, the elements of SA-7 went to the launch pad.

The first stage was erected on the platform. The second stage was piled on top of it. The small but complex instrument unit was added to the stack. Finally the Apollo spacecraft was mated to the rocket. A careful alignment check followed.

Then SA-7 was connected to the "umbilical tower." This open-grid steel structure, taller than the rocket itself, supports the "swing arms" that connect a rocket electrically, pneumatically, and hydraulically with its ground-support equipment. They disconnect and swing out of the way as the rocket begins to rise from the launch pad.

Now came many days of checking out the vehicle and its ground-support equipment together, including tests of automatic fueling procedures; on-board tracking beacons and ground tracking stations; launch vehicle-spacecraft compatibility; and radio interference. Finally an integrated "Overall Test" showed that the entire complex of flight and ground hardware was ready.

The countdown. Six hours prior to the planned launch time of 10:00 a.m., the countdown began.

First came installation or activation of the vehicle's "ordnance"—which stands for anything in it that can be ignited with a pyrotechnic fuse. In SA-7 the work of the ordnance crew included the installation of:

- The ignition device of the Apollo spacecraft's escape rocket.
- Initiators of explosive bolts to release the spacecraft's escape tower, and to separate the second stage from the first.
- Initiators of explosive "cutting charges" to open the vent ports prior to ignition of the second stage.
- Destruct charges to destroy the vehicle in midair, in case of an erratic flight.

This job, with checks of electrical connections and circuits, took about three hours.

At T minus 3 hours, the liquid-oxygen

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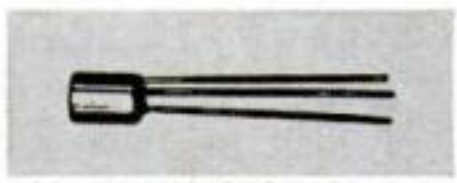

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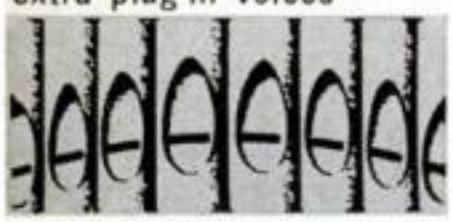

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tanks were filled, in the second and first stages in turn. (The kerosene tanks of the first stage had been filled days earlier.)

At T minus 2:30, the hatch to the Apollo spacecraft was closed and the service gantry was pulled back. Half an hour later, the launch pad was cleared of all personnel, and automatic liquid-oxygen and liquid-hydrogen "topping" systems that make up for evaporation losses were activated.

At T minus 45 minutes, the first-stage fuel tanks were pressurized. Various nitrogen purge lines were turned on to prevent combustible gas mixtures, caused by possible leaks, from accumulating in the craft.

At T minus 25 minutes, the environmental control system in the spacecraft was activated. Five minutes later, all spacecraft electronic systems were turned on—telemetry, tracking beacons, and so on.

Four minutes before launch, all electrical systems were transferred from external (ground) power to internal (on-board) power, and all electrical "bus" lines feeding into the ordnance systems were armed.

At T minus 2 minutes and 30 seconds, the "firing command" was given that transferred all further duties of setting systems in operation to an automatic sequencer. From this point on, the launch director and his assistants merely monitored the automatic sequence, ready to interrupt it at the slightest sign of trouble. The automatic-sequencing mechanism, however, has a rather intricate interlocking system that releases each step in the sequence only after the previous one has been correctly executed.

At T minus zero, the eight engines of the first stage were ignited. One second later, the umbilical swing arms disconnected and moved out of the way. The hold-down devices released at T plus 2 seconds—and SA-7 was on its way.

So there you have the why and how of the countdown. As you have seen, it is no space-age fad, but a deadly serious, carefully programed procedure, upon which depend the safety and success of a launch such as that of a great Saturn rocket. ■ ■

• • • •

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We made an actual time-motion study to prove you can save money, save time, do a better, cleaner job with new Weldwood® Panel Adhesive.

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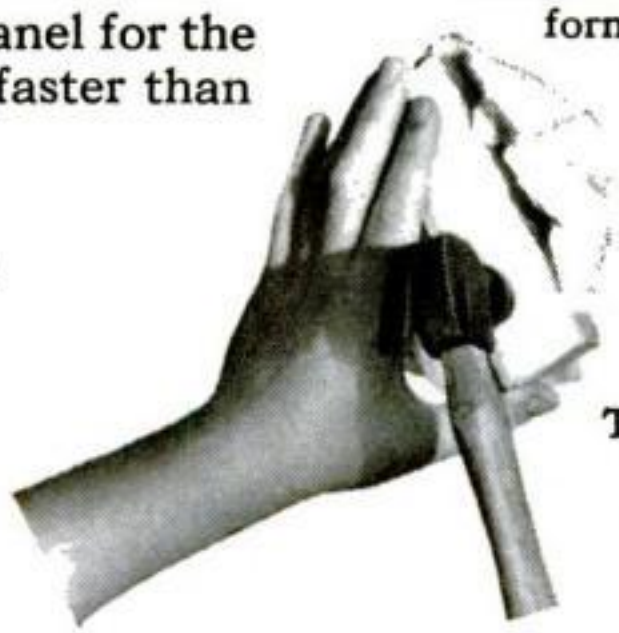
Pre-fit panels. Apply intermittent bead (3″ bead, 3″ space) of Weldwood Panel Adhesive to studs or furring strips. One cartridge installs five to six 4′ x 8′ panels.

Drive 2 or 3 small finishing nails to form "hinge" at top to hold panel in position. Hand-press panel against adhesive. Then swing panel bottom edge 8″-10″ from wall. Hold out with space block. After 8-10 minutes, reposition panel against wall and align accurately. Tap lightly against soft wood block to make full-surface contact. That's all there is to it.



Send for free new Weldwood Glue Chart. Hang this chart in your workshop and take the guesswork out of gluework. Tells you the right adhesive to use for just about every gluing job.

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Is Your TV Antenna Out of Date?

[Continued from page 71]

your serviceman install interference filters inside your set.

Is your set equipped for UHF? By federal law, every new TV set must be equipped to receive the 70 ultra-high-frequency (UHF) channels (14-83) as well as the 12 very-high-frequency channels (2-13). If you live within 20 miles of a UHF station, your present VHF antenna *may* pick it up. If not, you'll need a UHF antenna. You can purchase a separate UHF antenna and mount it in tandem with your VHF unit, or you can install one of the new all-channel VHF-UHF dual-band antennas.

Consider the latter idea if your present antenna is over five years old; it will cost less in the long run, and looks neater.

Do you have more than one TV set? If they are coupled to a single antenna, its output signal is being split up, and divided among the sets. If you are in a weak signal area, each set may not receive a signal adequate to produce a good picture. Solution: Update your antenna with a booster amplifier; it will compensate for coupling losses. Or install an antenna-distribution system in your home. This consists of a central booster amplifier and remote output sockets in every room. This is a good idea if you own a lightweight portable. You can view it anywhere in your home simply by plugging in its antenna leads.

If you use a rotator, then you have an additional problem: Every set must be tuned to the station located in the direction the antenna is aimed. The most practical solution is a "special" antenna—it's aimed in all directions at once.

Do you plan to buy a color set? You'll probably have to replace your present antenna if it's more than three years old—even though it works fine with your black-and-white set. Here's why:

A TV signal fills a band of frequencies six megacycles wide. Color signals are more complex than black-and-white—every nook and cranny of the six-mc. band is filled with vital information necessary to make a good color picture.

Many older antennas have a tendency to "suck out"—or remove—narrow portions of the band. You rarely notice suck-out on a black-and-white picture, but it can ruin a color picture if it prevents some of the critical color frequencies from reaching your set. ■■

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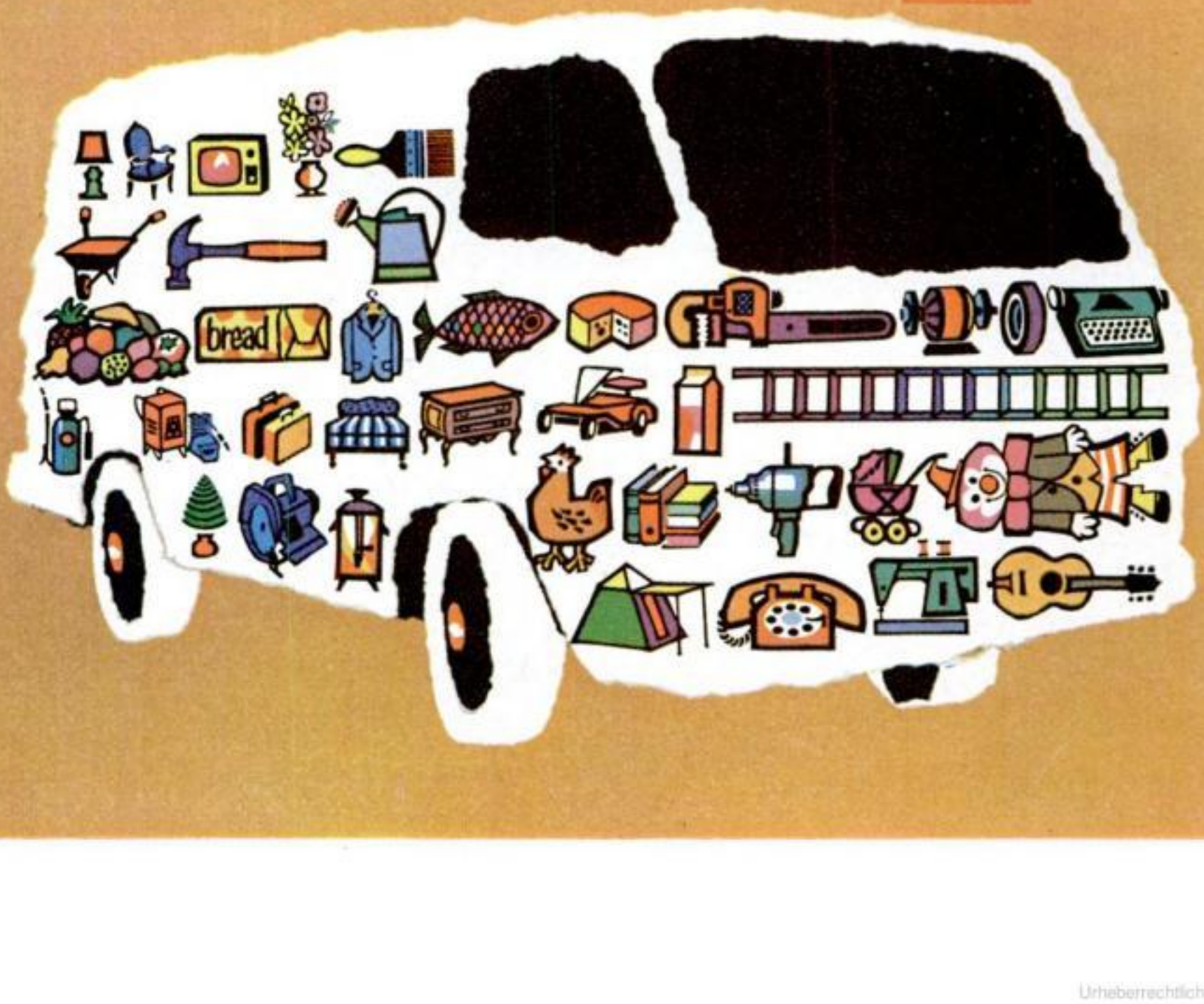
CHEVY-VAN DELIVERS ALL SORTS OF THINGS AT LOW COST

It has a low price tag, and it's built to work a long time and go easy on upkeep. The big body, with 211 cu. ft. of load space and flat floor, carries a full ton of cargo. Sturdy welded construction is thoroughly rustproofed. Side doors are available if needed. So is the powerful Chevrolet 230 Six, now offered for the first time in Chevy-Van. It's a lot of truck for the money, from big one-piece windshield up front to big easy-loading doors at the rear. See how nicely Chevy-Van suits the sort of things you deliver—at your Chevrolet dealer's.

CHEVROLET

Chevrolet Division of General Motors, Detroit, Michigan.



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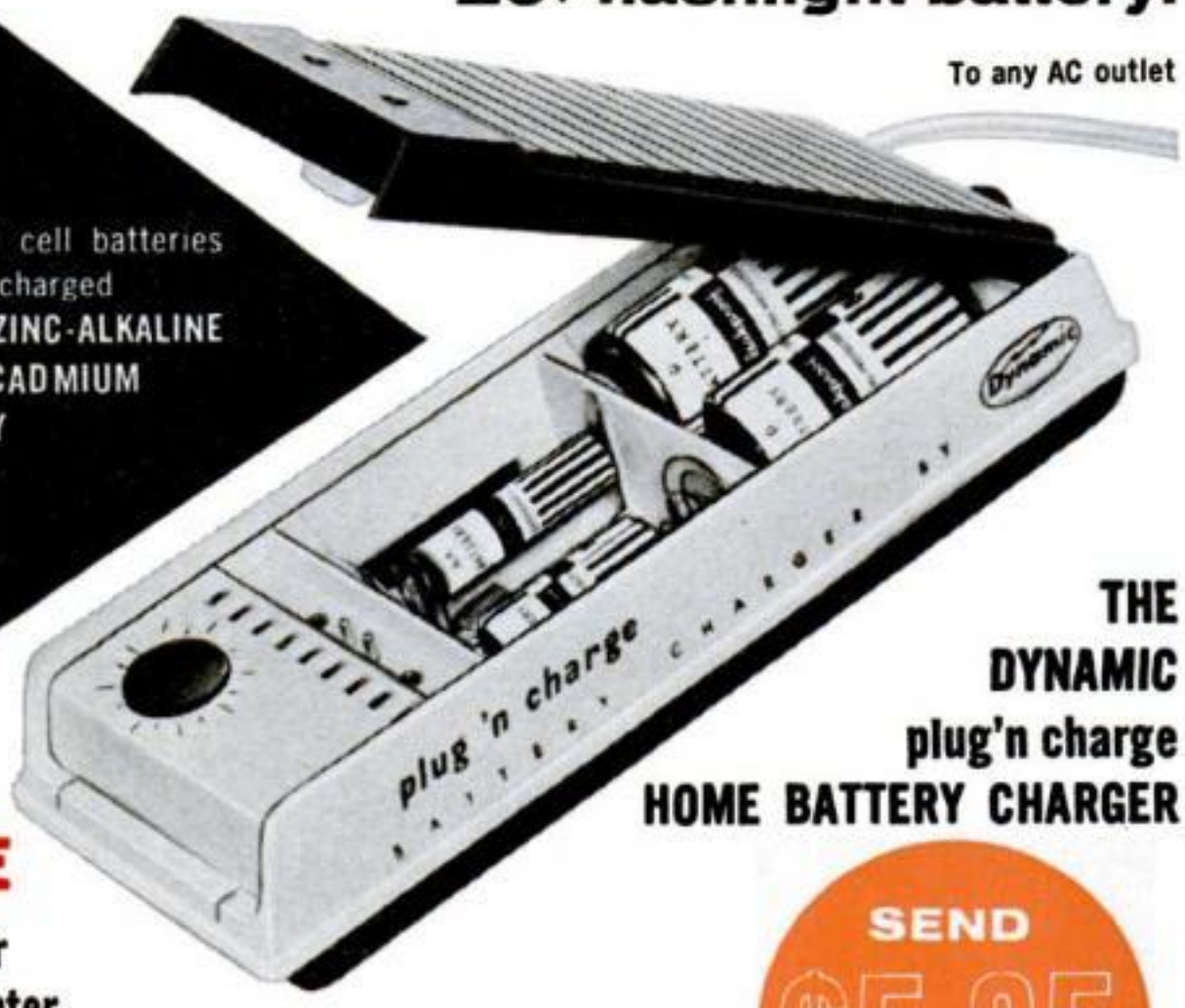

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How To Sharpen Everything

[Continued from page 141]

Punches for layout work may have a 60-degree point. For punching to start drills, a 90-degree point stands up better.

Carpenter's nippers. If the edges are beveled on the outside only, they can be sharpened on the side of a wheel. Take care to grind both edges parallel to the pivot pin so that they meet their full length. Stone off any burr inside the jaws.

Nipper edges having both an inside and an outside bevel are ground in three stages. First close the jaws gently on opposite sides of the wheel to dress down nicks and grind the edges parallel. Next, grind the longer bevel on the inside of the jaws. Finally, grind the outer bevel until the edges meet squarely their full length.

Side-cutting pliers. A slip stone small enough to work between the opened jaws may be used to whet the edge bevels at their original angle. Some inexpensive pliers can even be filed. A small cylindrical stone in an electric hand grinder can also be used for the job.

Taps and dies. You rarely suspect these of being dull; any extra effort in threading is blamed on the work. But cutting edges do break down and become dull.

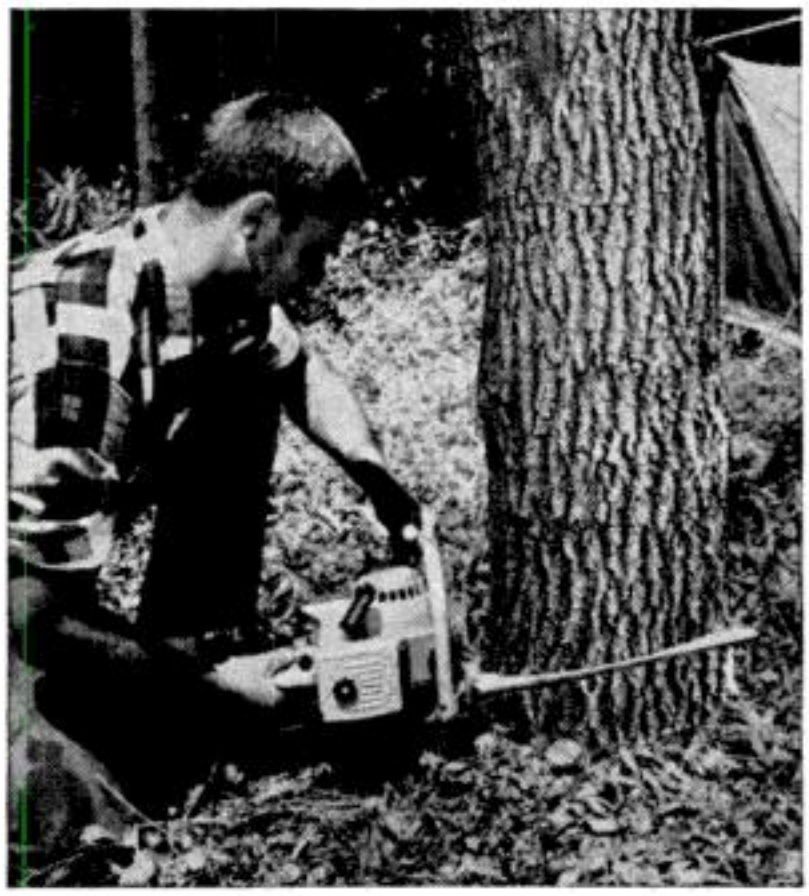
Taps can be sharpened by stoning the part of the grooves adjacent to the leading edges. Use a hard slip stone having a round edge, sliding it back and forth in the groove. It's also possible to use a pencil stone in a hand grinder, but don't let it climb the edge. Use a magnifying glass to check stoning or grinding progress.

To sharpen dies, use a round slip stone on the side of the clearance holes adjacent to the leading edges of the threaded bore. With a hand grinder, keep the stone moving back and forth.

Reamers. They will only rub inside the hole, once the tooth crests become rounded. Check them with a magnifying glass. At the first sign of rounding, whet the leading faces with a hard, round-edged Arkansas stone. Don't use a soft stone.

The tops of the teeth should not be stoned, for this would change the working diameter of the reamer. The faces, on the other hand, may be whetted several times without significant change in diameter.

If the tooth crests are nicked or rounded, the tool can be salvaged only by grinding the teeth down to a smaller size. This requires an indexing setup. ■■



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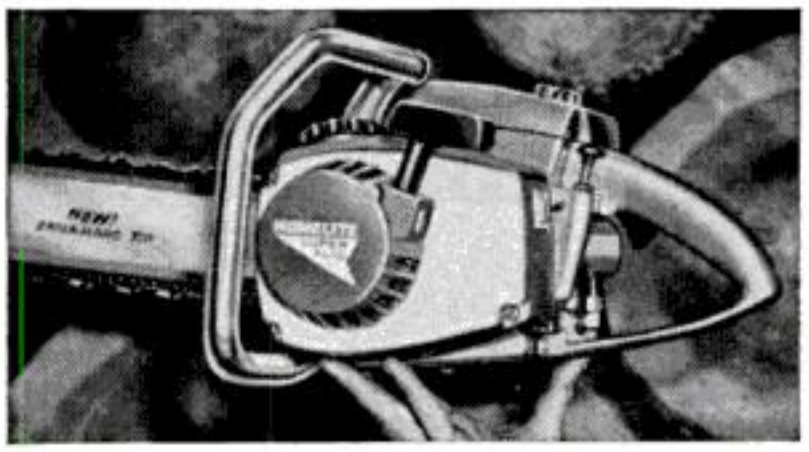

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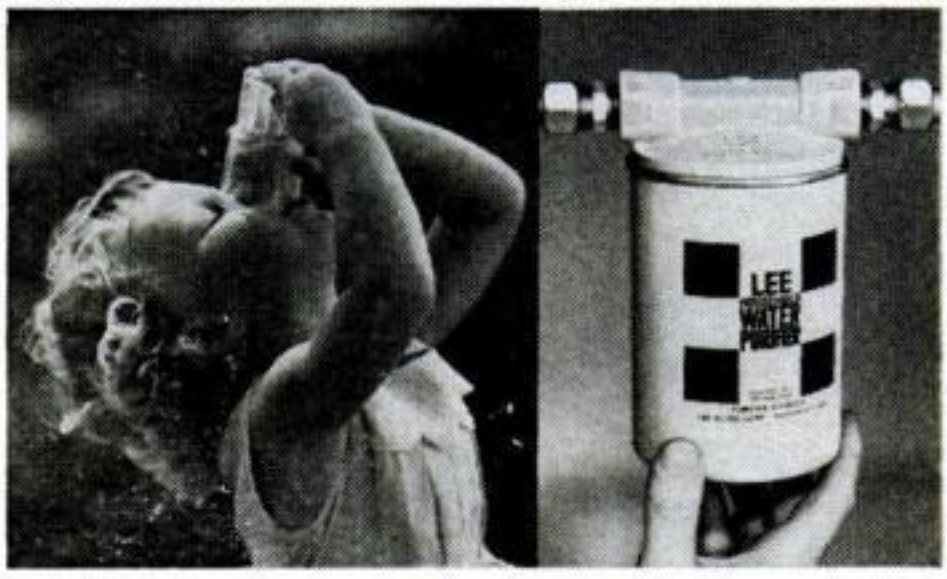

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[*Continued from page 99*]

extension phones. Others use transmitter cutoffs that allow listening in without clicks, loss of volume, or introduction of background noises.

How a snooper wiretaps your home. Here's how Samuel Dash, former Philadelphia district attorney and expert on wiretapping, describes it in his book, *The Eavesdroppers:*

Your telephone wires (called your "pair") lead to a pole near the house which has a junction box where they feed into a main cable. A wiretapper climbs the pole, flips open the junction box and looks inside. He may see 20 sets of terminals. He plugs his own small handset telephone into two of the wires, dials your number, spits on his fingers, and holds them across the terminals. If nothing happens, he's got the wrong line.

So he tries another pair. When his fingers tingle with a small shock, he knows he's rung your phone and pinpointed your pair. He quickly disconnects. Or, if you hear the ring and answer quickly, he may say: "Repair service; just testing."

He may have a confederate at a listening post in a nearby house. If so, he merely connects that house line to yours. His accomplice is now ready to hear and record any calls you make or get. He may even have a gadget that tells him what numbers you dial. Or he can string a wire three or four blocks to his parked car and run the wires down a pole into the car.

He could use a headset, but some neighbor might become suspicious, so he hooks the wires into his car radio.

How an office is wiretapped. One method is to have the switchboard girl plug an "executive override" extension to your line —so the company snooper can listen in or make a recording. If you ever try to signal your operator and can't get her, it may be because that sneaky extension circuit was improperly installed and is open.

Sometimes a wired or wireless bug may be concealed far back in a drawer where you never look. Anything you say is transmitted to a receiver in another room.

Your calls can also be tapped by a snooper who has access to the terminal box in the basement of your building. There he merely plugs another line into yours with a patch cord, or "loop."

One freelance wiretapper, whose clients included racketeers and movie greats, says

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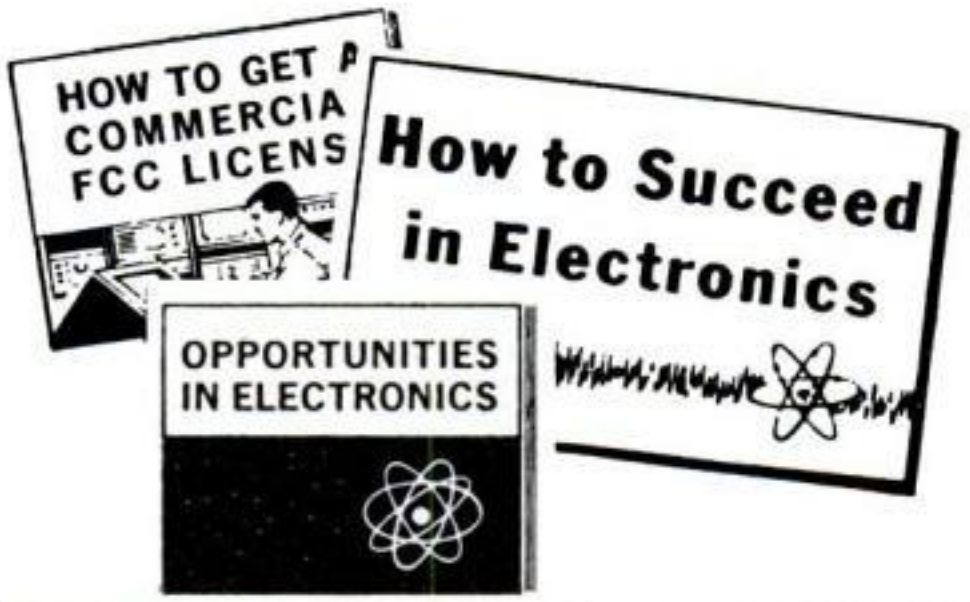

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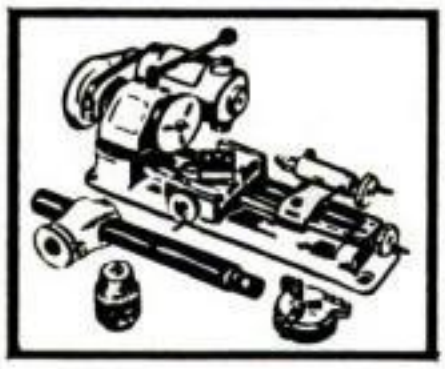

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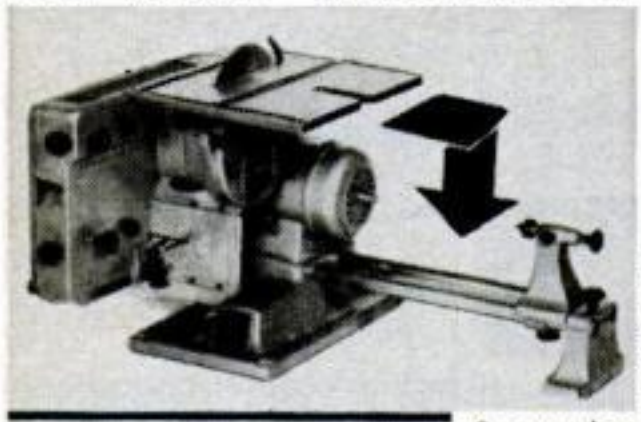

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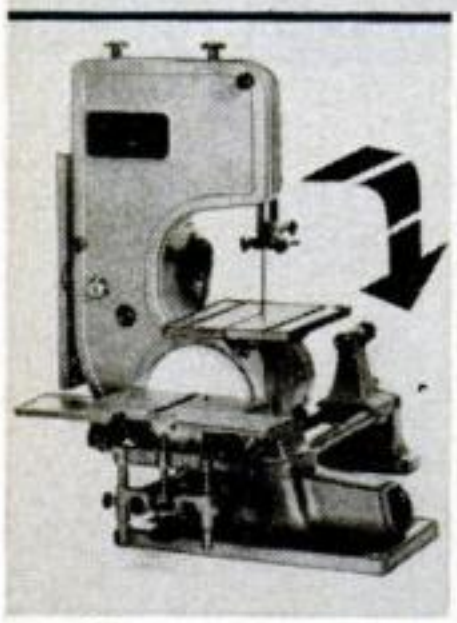

Swing the frame up as the arrows show. Effortless and it takes only seconds. Your band saw now operates, or you can use the *7-inch* disc sander, *the molder*, the *horizontal drill*, and the *power grinder*. Yet the complete Multi-Matic 8 stores in less than 4 square feet. No workshop space is too small and no woodworking job too big! Multi-Matic 8 is portable too. With motor built in, wired and ready to run, price is only $269.50.

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Are They Listening In on You?

that most companies would not dream of wiretapping their employees. But others, less scrupulous, do. One millionaire businessman boasts, "I record every call I make or get."

If you don't like snoopers around your house or office, here's what you can do:

1. Rent or borrow a small mine detector. These are readily available from supply houses that serve the building industry. They are also used by experts who call themselves "anti-intrusion specialists." A mine detector will change the pitch of its sound when passed near a wired mike.

2. Buy a small used neon sign and turn it on near your phone when you talk. A snooper will hear nothing but the loud buzzing radiated by the sign's transformer. This works only with an induction coil, not with a wired tap.

3. To detect a wireless mike, you can use a special FM set tuned to 74 megacycles. A squeal is your tip-off. Leave the set on to jam the FM channel.

4. Talk quietly and turn on a nearby radio set—fairly loud, to balk wireless mikes. Today's snooper devices can eliminate certain interfering tones, but these tricks still work. So does the business of letting water run in a shower.

5. Call the phone company if you see a suspicious man working on a pole or near your wires. If a repairman comes to your door, check with the phone company before admitting him. (Credentials are easily faked.)

6. Check with the phone company if you hear your phone ring and a voice says, "Just checking."

7. Notify your phone company, the FBI, the FCC, or any other law-enforcement agencies if you hear persistent "funny sounds." These sometimes occur in stormy weather but shouldn't persist. A good telephone line is silent. Strange scratchings, an echo, or odd delays are a tip-off of a tap.

So are faint voices. These used to be caused by induction from other wires. But today's lines are better. Such sounds are sometimes caused by an imbalance in the circuit, due to unskilled wiretapping.

8. If you're a top-secret man, you can buy a portable telephone conversation scrambler for about $275 a set. It's held against the phone and changes your voice into unintelligible sounds that can only be unscrambled by a matching device. ■ ■

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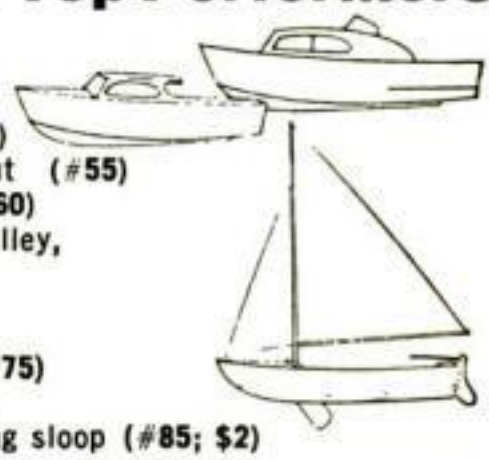

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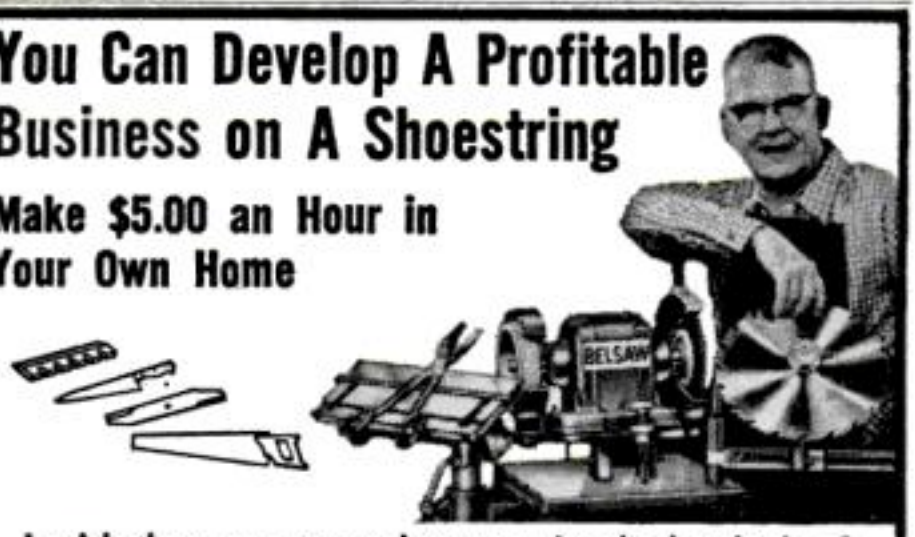

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How to Sweeten a Lemon

[*Continued from page 91*]

out in a few thousand miles, scoring the drum, because of a faulty self-adjuster, the factory made good on every part.

The deluge. Customer complaints forestall trouble for other owners. A Texan bought a convertible against the advice of his wife and mother-in-law. They agreed to a top-down ride to the country club on a balmy evening. All went well until a Texas-style thunderstorm materialized out of nowhere. When the proud owner pressed the button to raise the power-operated top, he was greeted by a deluge instead of a covering top.

While the factory official was unable to get the wet Texan out of the family doghouse, he did save future convertible enthusiasts from a similar fate. Investigation revealed that during assembly a sheet-metal screw had pierced one of the wires to the convertible-top motor, grounding it to the floor pan. Designers rerouted the wire.

Getting action the hard way. Some owners, convinced that the dealer and the auto maker couldn't care less about service problems, resort to drastic action. A favorite tactic is to paint lemons on the vehicle.

A dealer finding a lemon-emblazoned car in front of his salesroom may retaliate in kind. In New York City, a disgruntled customer plastered his car with lemons and parked in front of the dealer's door.

On the following morning, a traffic officer "just happened to be" outside when the dissatisfied owner cruised up the street, spun around in the middle of the block and pulled up to the curb. The cop presented the driver with a ticket for an illegal U-turn.

Not all complaints involve service problems or defects in a car. Sometimes an eager salesman promises to "throw in" a set of white-wall tires, a side mirror, or some other extra-cost item to clinch the sale. By the time the car is delivered, the promise may have been forgotten or the item discontinued. Solution: To avoid misunderstanding, insist that every piece of equipment be listed on the order.

Getting the benefit of the doubt. The customer isn't alway right, of course. But right or wrong, you, as a car owner, swing a lot of weight in a multibillion-dollar industry. As one factory official puts it, "We expect every owner to receive everything to which he is legitimately entitled, and to get the benefit of any reasonable doubt."

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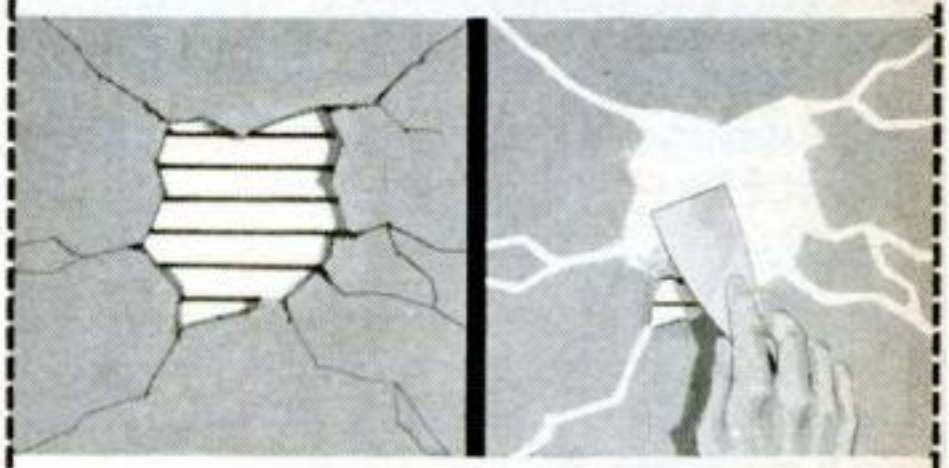

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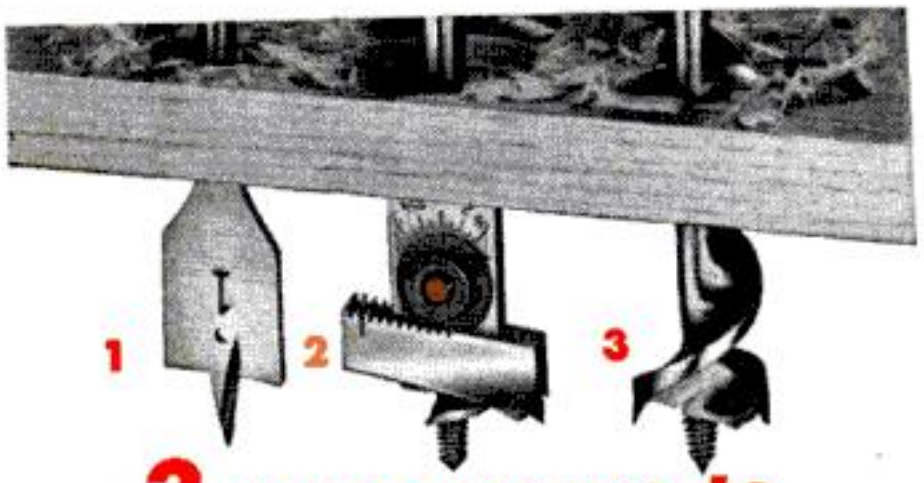

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Was John Glenn Injured in Space?

[Continued from page 59]

ear research—the first doctor they sent into space on their multimanned rocket last October was an inner-ear specialist.

But the vulnerability of the inner ear is only one of the physiological problems we have to solve before we learn whether man can venture into space for months, or even years, at a time and return unharmed. The main problem still to be solved, Dr. Wagner told me, is the effect of weightlessness on the cardiovascular system—the heart and blood vessels.

A hint of possible trouble in this area was shown in the last two Project Mercury flights. Dr. C. A. Berry, the astronauts' personal physician, told me Mercury pilots Walter M. Schirra and L. Gordon Cooper suffered from a slight breakdown—called orthostatic hypotension—of the cardiovascular system. Russian scientist V. V. Parin said that cosmonauts Andrian Nikolayev, Pavel Popovich, Valeri Bykovsky, and Valentina Tereshkova also experienced similar symptoms after their flights.

The condition is marked by a pooling of blood in the legs and a shortage of blood circulation to the brain. It occurs when the heart and blood vessels have to work less strenuously in the gravity-free state.

Starved brain. Space voyages involving extended periods of weightlessness allow the blood vessels in the leg to relax. So instead of helping pump blood back up as they ordinarily do, they stop functioning. The heart, which is working less hard to pump blood, doesn't mind this while the astronaut is still weightless. But when he re-enters the atmosphere and steps out of his capsule, most of the blood that his heart pumps goes to his legs. Since the leg's blood vessels are unable to begin functioning immediately, the blood pools there. Then the heart can't pump enough blood to the brain. In Cooper's case, it caused him to faint, but Schirra showed only a drop in blood pressure and pulse rate. Neither suffered any lasting effects.

Dr. Lawrence E. Lamb of the Brooks Air Force School of Aerospace Medicine, San Antonio, told me about his research to find a solution to this problem, which he said may not be caused only by weightlessness.

Confinement and a lack of exercise in the space capsules may be other factors. Part of the difficulty in pinpointing the

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cause has been our inability to simulate the weightless state, except for a fraction of a minute in parabolic jet flights. But by conducting tests on men subjected to extended periods of bed rest—which produces physical symptoms similar to those of weightlessness—he has found some clues to overcome this difficulty. The main solution seems to be adequate exercise to keep the cardiovascular system stimulated.

Lack of exercise can also damage an astronaut's bones. They may begin losing calcium when attached muscles stop pulling on them. Russian scientists reportedly found increased calcium in the urine of the pilots who made the twin-orbit flights in 1962.

And radiation? Will it trouble space pilots? It hasn't so far, because the flights have all been well below the level of the Van Allen belts. But when we start trying to push through these deadly areas, trouble may come. It's hoped that the speed at which capsules will travel through the belts will keep dosages within safe limits.

Finding a suitable air mixture for astronauts to breathe is another unsolved problem for extended space voyages. So far, the astronauts have been using a pure-oxygen environment that is believed safe when administered at a lower pressure than we breathe at normally. But some studies [PS, Aug. '63] have revealed that breathing pure oxygen, even at reduced pressure, produces anemia and impaired vision. It may become necessary to devise other gas mixtures for astronauts.

The list of medical hazards could go on and on, and there is no complete agreement on how man will react in space to these physical factors. Just as there is no complete agreement on what caused John Glenn's inner-ear trouble.

Officially, Glenn got sick after falling—but what about the experts who believe that it could have resulted from a space accident or from the grueling training astronauts receive?

When I asked Dr. Torquato Gualtierotti, Professor of Physiology at Italy's University of Milan, and currently a visiting scientist at NASA's Ames Research Laboratory, Moffett Field, Calif., whether Glenn's injury was actually caused by a fall, he replied: "I have no reason to think differently." But he pointed out that even Glenn's own doctors could not be certain,

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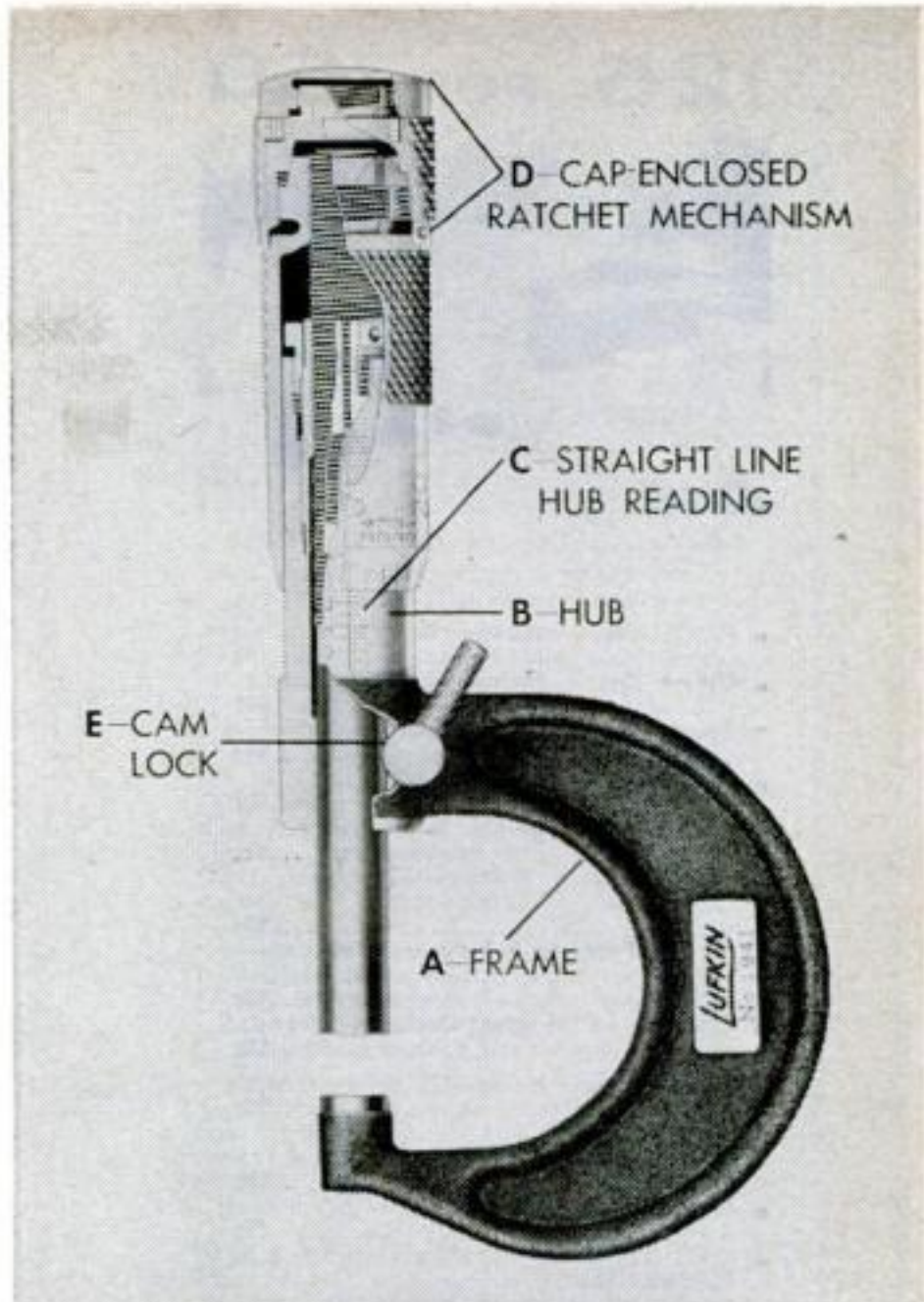

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Dr. Gualtierotti is seeking to devise tests that would measure the precise effect of weightlessness and acceleration on the inner ear. He has warned NASA that men could suffer serious, and perhaps fatal, airsickness from the effects of weightlessness on the inner ear.

The culprit. One possible reason for trouble: The otoliths in the inner ear—tiny stone-like particles, no bigger than fine grains of sand, suspended on hair-nerve endings—are overstimulated by rocket acceleration. Dr. Gualtierotti says the otoliths weigh many times their normal weight as astronauts are blasted free of our atmosphere at about eight times the force of gravity. Animal experiments show, he says, that hemorrhages and other injuries occur in the inner ear when it's subjected to 10 to 15 times the force of gravity, and perhaps less. He believes these injuries could cause dizziness.

I found it strange that those closely connected with the manned space effort seem to discount such fears. But the men who will fly the Gemini and Apollo missions seem confident.

"We don't see anything that's going to interfere with being able to drive these things [space capsules] around in space," Shepard told me.

Shepard's status as a pilot in future missions is still in doubt. Doctors are waiting to see whether his inner-ear problems are completely over.

Glenn, who has now regained his health, has resigned from the man-in-space program for a career in industry.

Late last year, he was promoted to full colonel by President Johnson, who remarked humorously (and erroneously) at the end of the ceremony that it was unusual that "a man who orbits the earth and has Congress stand in rapt attention still doesn't know how to stand up in a bathtub."

On this light note, Glenn bowed out of the space program. But the question of what caused his injury remains unanswered. Until science learns more about the effect of space on man's body, there won't be complete agreement by medical experts on what happened to John Glenn's inner ear. ■ ■

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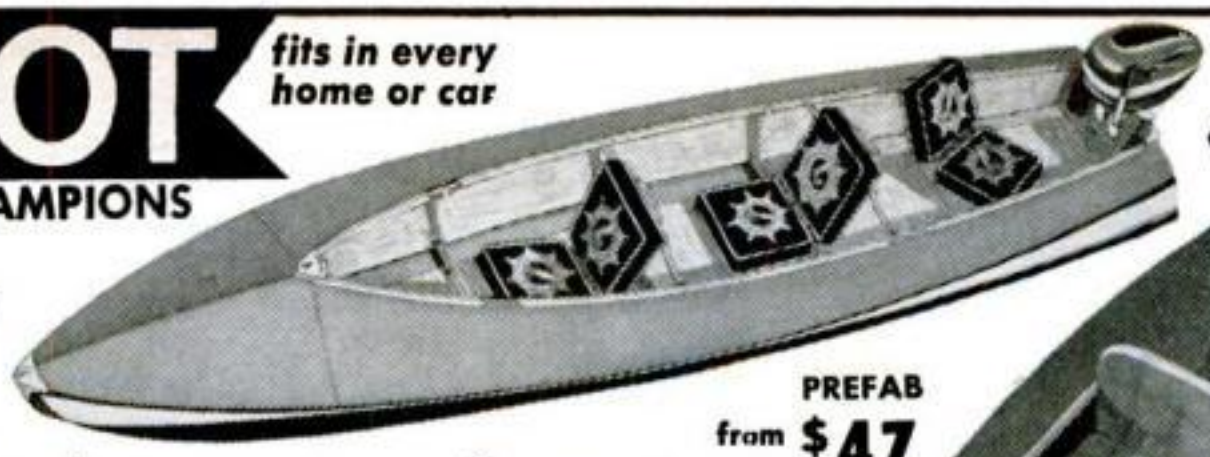

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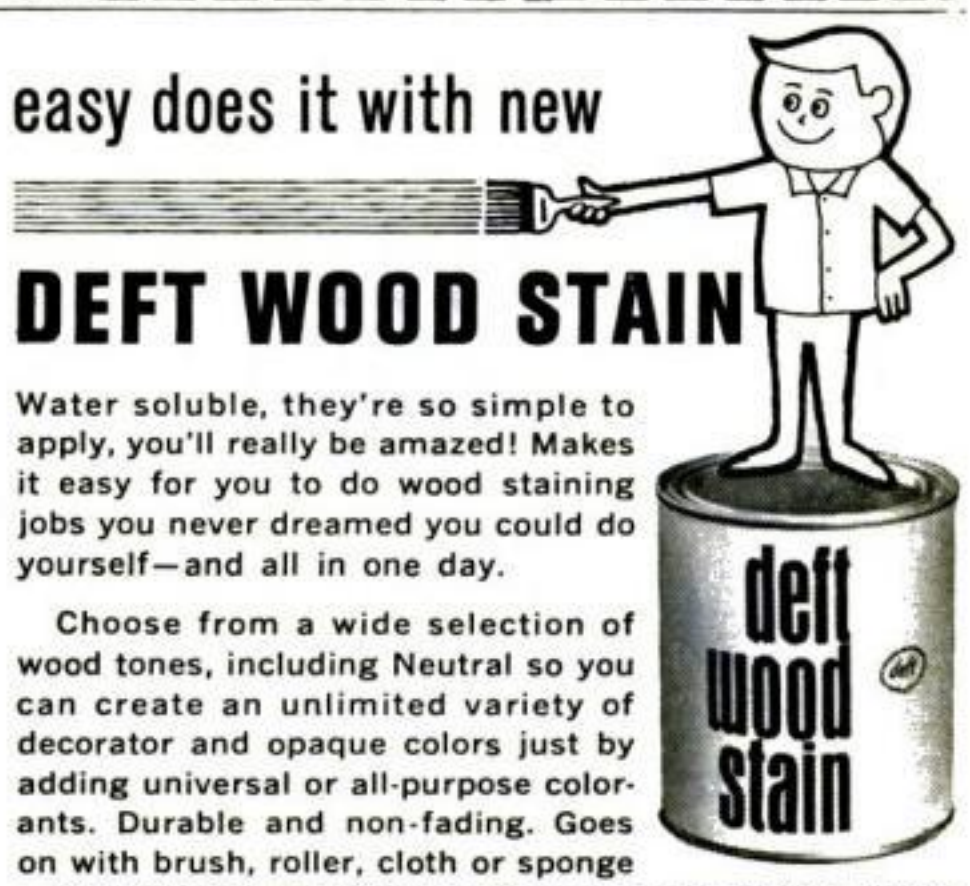

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Which Shop Vises Do You Need?

[*Continued from page 155*]

vise and usually looks so much like it that you may not be able to tell the two apart by eye. The big difference: The machinist's vise is made of malleable iron instead of cast iron. You can pound on it without danger of its cracking. It's more expensive—prices start at $30 and average closer to $70—but it's the vise to pick if you plan to do a lot of heavy hammering, metal bending, and cold-chisel work.

Another version of the machinist's vise is made specially for shaping sheet metal. It, too, is made of malleable iron, but its jaws are thin and sharp-pointed so you can bend metal cleanly over them.

The woodworker's vise. This does woodworking jobs that the bench vise can't do. It and the bench vise are the two that no shop should be without.

The woodworker's vise mounts below, not above, the bench. This keeps the bench top clear and puts the work down where you can saw, plane, or chisel it more easily. The jaws are broad and smooth for gripping wood without marring it.

Look for two features on better-quality models. One is a metal dog in the outer jaw that can be raised above bench level to clamp large work against a bench stop. The other is a quick-acting jaw that can be slid open and closed without going through a lot of laborious turns of the handle. The jaw's screw, held in a split nut, engages only for the last turn or two required to tighten the jaw against the work. Prices start at about $7.

Machine or drill-press vise. This is sometimes confused with a machinist's vise, but is a completely different animal. It is designed to position small work very precisely for delicate machining jobs like drilling, tapping, milling, etc. It has a low, flat, stable base with holes or slots for bolting to a drill-press table.

Various styles are available. You have to pick and choose carefully to get what you want. There's a fixed-base type, the simplest and cheapest; a type that tilts, one of the most popular; a type that both tilts and swivels; a type that slides sideways and swivels but doesn't tilt, and so forth. In some makes, it's possible to convert one type to another, for example by attaching a fixed or tilting model to an auxiliary swivel base. If you think you will want such features in the future, be sure the vise

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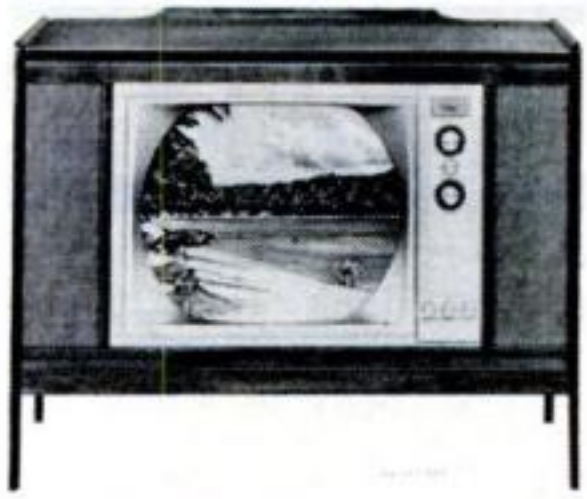

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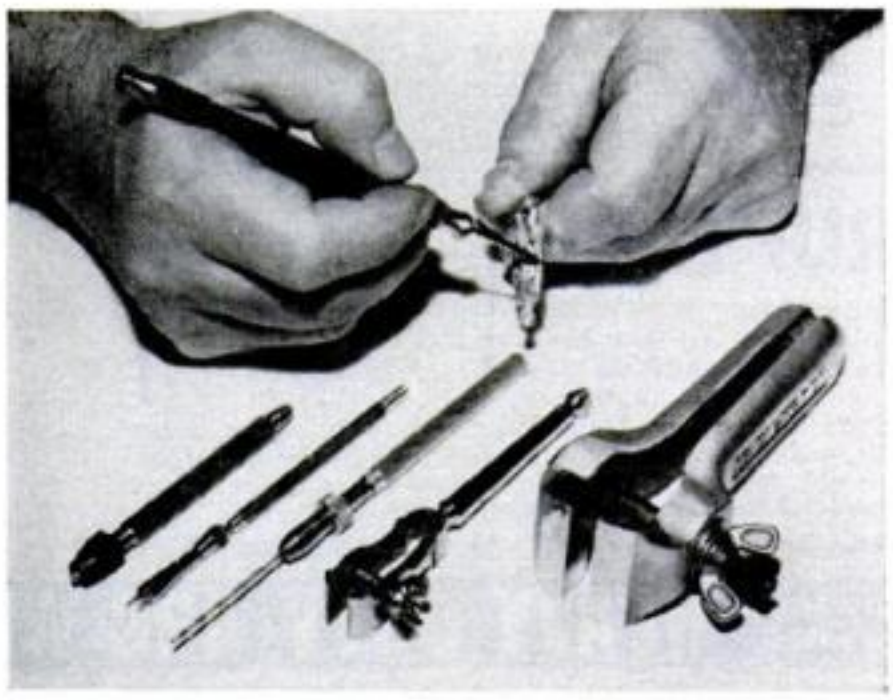
Pipe vises—do you need one? You don't have to be a plumber to own a pipe vise. While they're designed basically for pipe, they make it easy to hold any kind of round stock—tubing, conduit, rods, shafts, etc.

There are two basic types. In the yoke vise, two curved, toothed jaws are squeezed together. In the chain vise, a chain is pulled tightly around the object to hold it. The chain vise is somewhat more versatile because it can grip a variety of odd shapes in addition to round ones. In small sizes handling up to 1½" or 2" diameters, pipe vises cost as little as $5.

Vises that do special tricks. There are ingenious special vises that do jobs the others can't do, or do them more easily. The two shown at the beginning of this article are good examples of vises that may solve a particular problem in your shop.

The Gyro-Vise is a bench type with a few tricks of its own. It swivels and tilts to put the work at any desired angle, and its jaws are designed to take both wood and metal. The combination vise and clamp handles big-area jobs like edge-gluing boards, not possible on other vises.

At the opposite extreme are miniature hand-held vises that grasp tiny parts or tools better than your fingers can. Obviously, there's no such thing as one shop vise. There are as many as you have jobs for. ■■



Hand-held vises come in many types and sizes. The two at right have jaws like a conventional vise that can be tightened to grip small parts while you work on them. The smaller ones, known as pin vises, hold tiny knives, drill bits, scribers, and other delicate tools.

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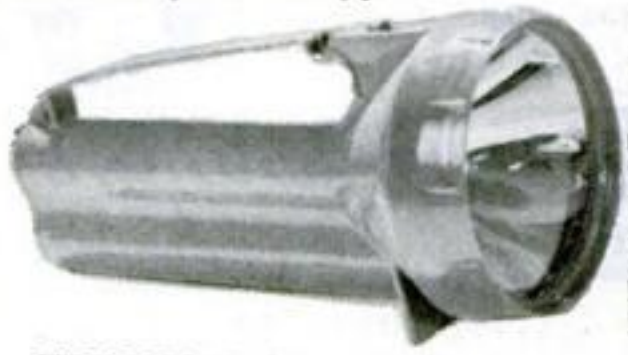

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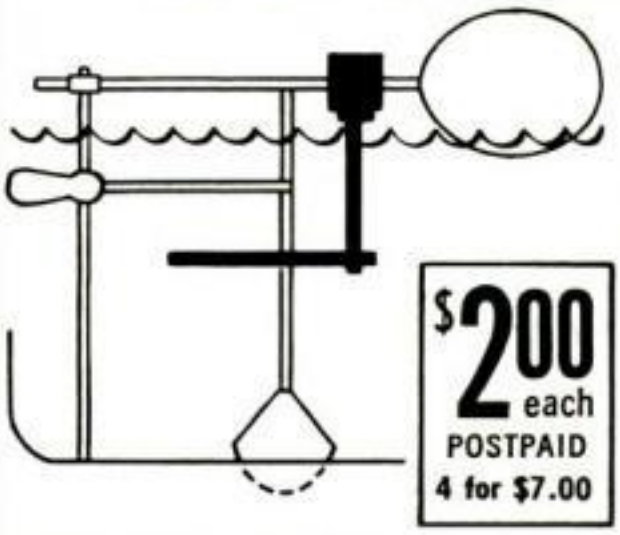

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The '65 Corvair: How Much Better?

[Continued from page 75]

earlier unmodified Corvairs on rough roads has been banished.

The new body is wider and has two more inches of leg room in the rear.

Of the four Corvairs, new and old, that I tried, I liked the '65 Monza coupe best of all. With the windows rolled up, it's lots quieter than the buffeted convertible with its bellicose engine booming out through the 2½-inch exhaust stack.

However, to give the turbocharger its due, in spite of the high speeds and hot acceleration that I gave it, the gas mileage averaged out to 16.9 miles a gallon.

Some squawks. The closed body was squeak- and rattle-free on the '65, but on both Monza and Corsa coupes there were signs of what I call "early assemblyitis"—a malady that sometimes crops up at the start of a new-car run. On the convertible, for example, there was a gap between vent frame and windshield post that whistled with incoming cold air.

The '65 Corvair is tremendously improved. But the man who can paint the lily is John Fitch, who has been converting and selling parts to modify Corvairs for the past three years at Falls Village, Conn.

About $170 worth of Fitch's Sprint parts bolted onto the '65 Corvair turn it from a very good handling car to an excellent one that's even more fun to drive and comes close to qualifying as a true sports car. For example, there are springs and shock absorbers to decamber the rear suspension and "tie down" the entire car, as well as new steering arms to cut ratio from 23:1 to 16:1 for fast, responsive steering. Coupled with this is a hydraulic steering damper (it looks like a screen-door closer) that takes the twitch and wind wander out of any Corvair.

John also has Sprint parts for the engine, including a free-flowing exhaust system, carburetor and jets, and ignition-timing alterations that boost the stock 110-hp., premium-fuel engine to either 125 or (with two more carbs) to 155 at high r.p.m.

But whether with Sprint modifications or just as the factory delivers it, I found the '65 Corvair to be basically as comfortable riding and a lot better handling in normal driving than most big cars. As a coupe (I like the quiet!) with the 140-hp. engine and Sprint suspension modifications, I found it very enjoyable transportation. ■ ■

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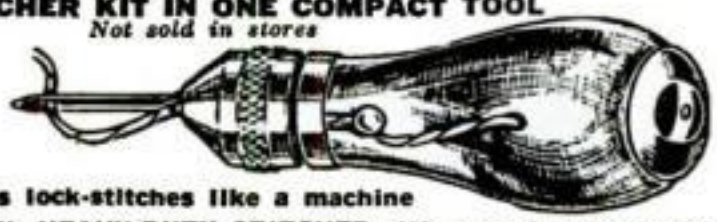

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Look What's Happening to SLRs

[Continued from page 145]

enced users of other reflexes and view cameras, prefer the full-area focusing of the plain ground glass.

Lens mounts. Lenses of focal-plane-shutter cameras are either screw- or bayonet-mounted; the latter system is used in all behind-lens leaf-shutter models.

Although similar in principle, mounting systems differ from camera to camera. For some models, the number of adaptable lenses is limited. If you plan to equip your SLR with lenses of various focal lengths, look into this point. Incidentally, there are more lenses available with the Pentacon screw mount—shared with several other cameras—than any other mount. In some instances, lenses may be converted from one type of mount to another, using inexpensive adapters.

Lenses. Usually, a 35mm reflex comes equipped with a 50-58mm "normal" lens. For a bright finder image, its maximum aperture should be f/1.8 to f/2; available-light photographers find f/1.4 preferable.

The normal lens is best for general use. Don't become a lens collector just because you have an interchangeable-lens camera. First learn to use the normal lens effectively; add other focal lengths as you find need for them. In my opinion, the most useful second lens for the average photographer is the 100mm or 105mm.

The 35mm SLR is the only still camera for which zoom lenses are available. While I've found the zoom lens an interesting creative tool, I cannot recommend it as an effective substitute for individual lenses within its range of focal lengths. Most zoom lenses are heavy and bulky, as well as expensive, and usually not capable of as good results as you can get with conventional lenses.

Exposure control. All leaf-shutter and a number of focal-plane-shutter SLRs now offer some degree of exposure-control automation. Several leaf-shutter cameras are fully automated: The built-in meter automatically sets the exposure. This is fine for the occasional snapshooter, but not for the serious photographer who wants to maintain full control over aperture and shutter-speed settings.

More practical are exposure-control systems in which you set the film speed and either aperture or shutter speed, then point the camera at the subject and, turning the

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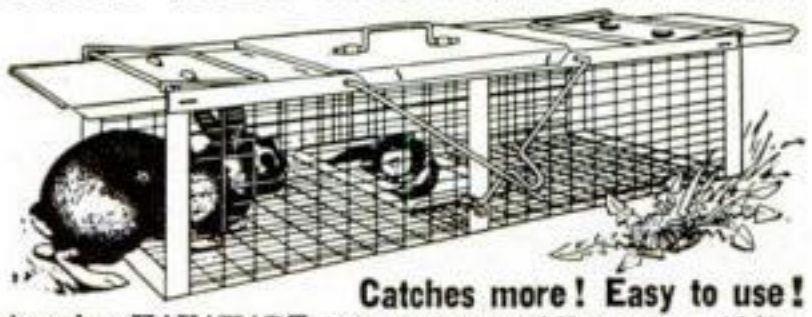

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other control, establish that setting by lining up the meter needle with a reference point—both of these visible in the finder. Such coupled meters are built into some cameras, provided as attachments for others.

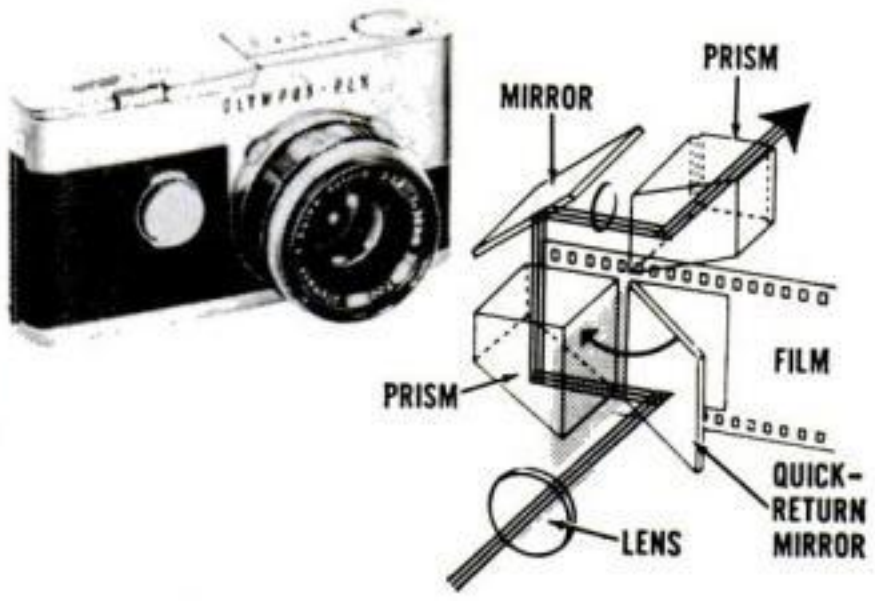
The most advanced exposure-control systems of this type are found in the Beseler Topcon Super D and Alpa 9d, which have behind-the-lens CdS exposure meters.

There is a trend toward the use of CdS rather than selenium cells in built-in meters. CdS meters have greater low-light sensitivity and, because of the small intake window required, take less space.

All built-in, coupled exposure-control systems are complex and delicate mechanisms, more or less susceptible to getting out of order. They run the cost of a camera up, and they're expensive to repair. You'll have to decide if the added convenience is worth the cost.

Camera body. This element in the choice of a camera is more personal than any other. You really have to use, or at least handle, a camera and work the controls to see if it feels right to you. Note whether or not the controls are conveniently located and comfortable to operate—the size of your hands has a lot to do with this.

Some SLR cameras have hinged backs; in others, the back must be removed for loading and unloading film. Removable backs usually are provided to accommodate motor winds, special film magazines, etc. When a tripod is used, the hinged back is more convenient—you don't have to dismount the camera to reload. ■■



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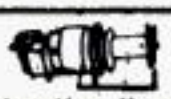

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Helpful Pointers on Knives for Outdoorsmen

[*Continued from page 122*]

one way to make the blade rustproof even though it's made of rust-prone carbon steel.

3. The factory edge should be sharp and clean, with no flat spots.

The handle. In selecting a knife, the feel of the handle is more important than the material.

Traditional handles are bone, wood, or leather. But many handles today are made of good plastics, epoxies, and aluminum for lighter weight and great durability.

The sheath. There are two types of sheaths: pouch and boot. The pouch sheath usually has a little strap that holds the knife handle in place. The boot sheath doesn't need this because it swallows nearly the whole knife. A pouch sheath should have a belt loop, rather than two slits in the back. A handle stop and a third layer of leather at the seams help to keep a knife from cutting through.

The trouble with sheaths is that they rot or wear out. Keeping the leather dry will help prevent rotting. A fiber insert in the pouch will slow down wear.

Folding knives. Pocketknives come in four basic styles: jackknife, penknife, three-bladed and four-bladed utility knives.

A jack has its blades hinged at the same end, opening the same way; a pen opens a blade each way. You can figure the others out easily.

A good folding knife clicks open and snaps shut smoothly. The blades should not touch each other or the linings. When you buy a pocketknife, make sure the bolsters are solid. The handles should fit tightly to the bolsters, with no gaps along the back.

Taking care of a knife is simple: Don't let it rust and don't abuse it—and most of all, keep it sharp. [See "How to Sharpen Everything," Part 3, PS, Oct. '64.] ■ ■

Addresses of manufacturers and distributors of knives described in this article are:

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A.C. Buck Co., 3220 Congress St., San Diego, Calif.

W.R. Case Co., Bradford, Pa.

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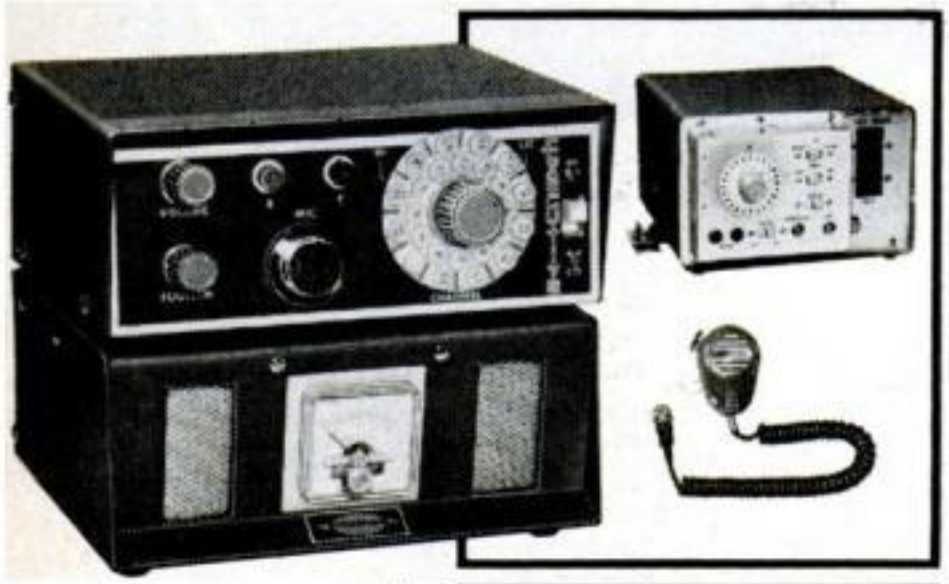

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A Copy Machine You Can Build

[Continued from page 130]

Paint the inside of the light box flat white; use your imagination on the rest of the copier. Apply several coats of chemical-resistant paint (epoxy paint is perfect) to the interior so that any spills of the developing solution won't sink into the wood.

The light source. Twenty "candelabra"-style bulbs (7 watts each), mounted in a neat rectangular pattern, produce uniform illumination at the top of the light box. A surface-mounted receptacle, screwed to the back and connected to a line cord equipped with a line switch, carries power to the photocopier. This is nothing more than an extension cord fastened to the back. An inexpensive photographic-enlarger timer controls exposure time under the light bulbs. The timer plugs into the receptacle, and the lamp circuit plugs into the timer.

The developer. For perfect copies, the solution must be kept at about 82 degrees F., or slightly above average room temperature. An effective "heater" can be made from a heating pad (bought at a drug store or appliance shop for $6 or $7). Make sure the pad you buy is labeled "completely waterproof." Discard the pad's cloth cover and fit the pad into the bottom of the copier. The *high* heat position of the pad switch will warm the solution to 82 degrees in a few minutes; the *low* heat position will keep temperature constant. Use a photo thermometer to check temperature.

The "works." The plastic rod rollers must press the developed matrix paper against a sheet of copy paper, but learn to press gently when you make a copy. The squeegee wipes off excess solution from the matrix paper *before* the matrix paper and copy paper come in contact. Its adjustment is critical. If it presses too hard against the wet matrix paper it will smear or scratch the surface and ruin the copy; if it doesn't press hard enough, too much solution will remain on the matrix paper and cause smeared areas on the copy.

Make the squeegee from a length of soft vinyl door-jamb weather stripping bolted to a free-turning plastic rod. Adjust its spring tension so that it presses very lightly against the bottom roller.

Practice makes perfect. Experiment with exposure and developing times, and plastic-roller pressure, until you find the perfect combination. Once you get the hang of it, you'll turn out a copy-a-minute. ■ ■

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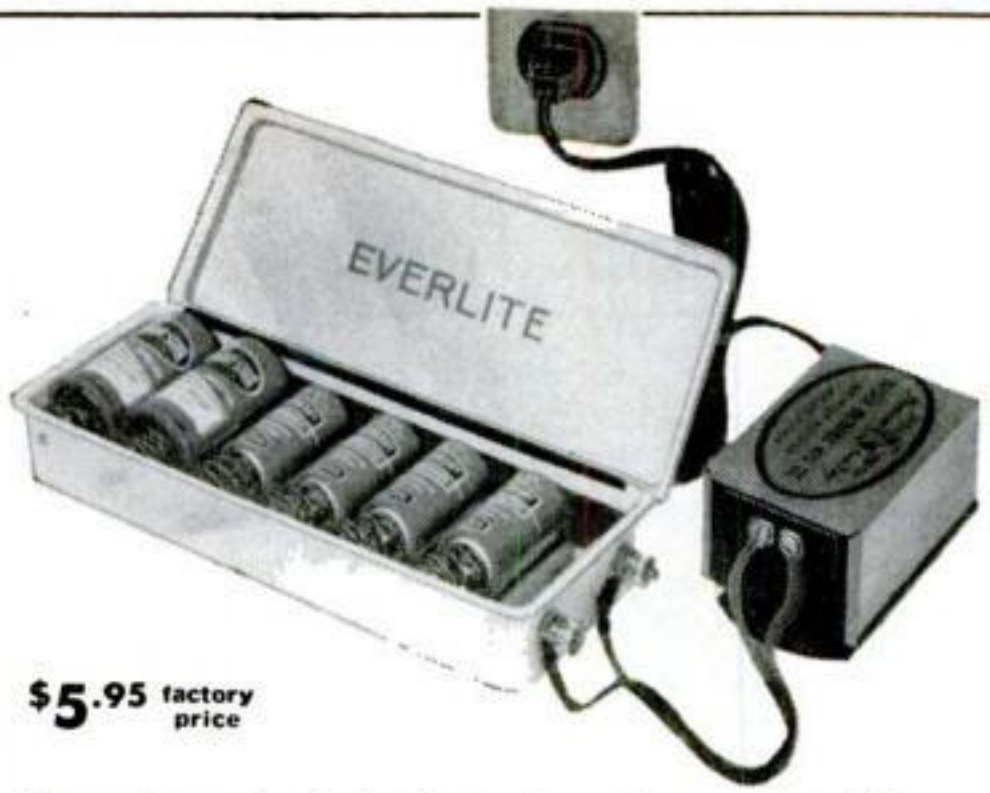

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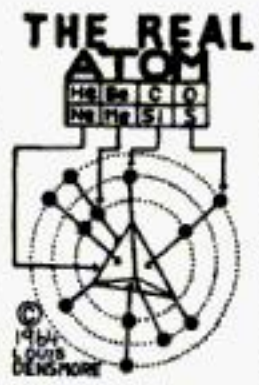

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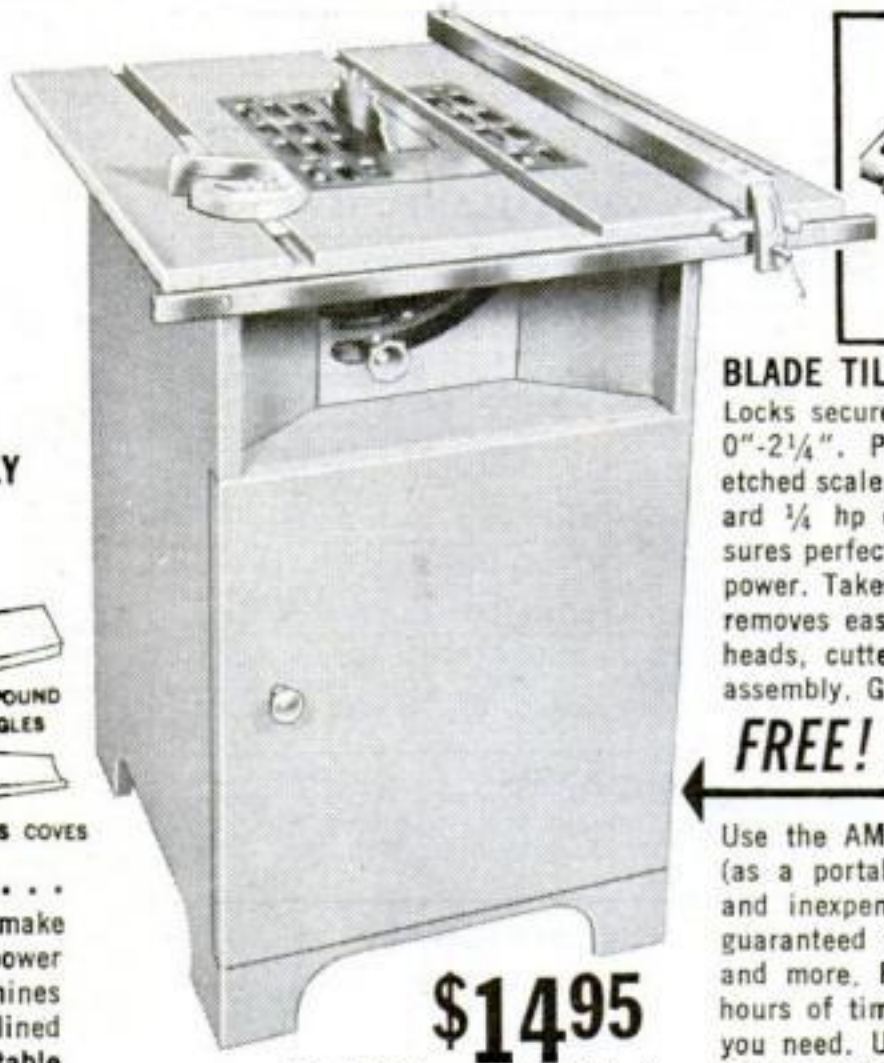

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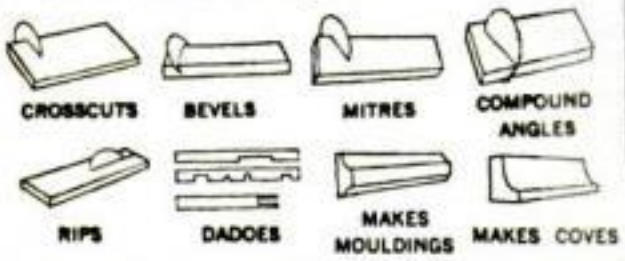

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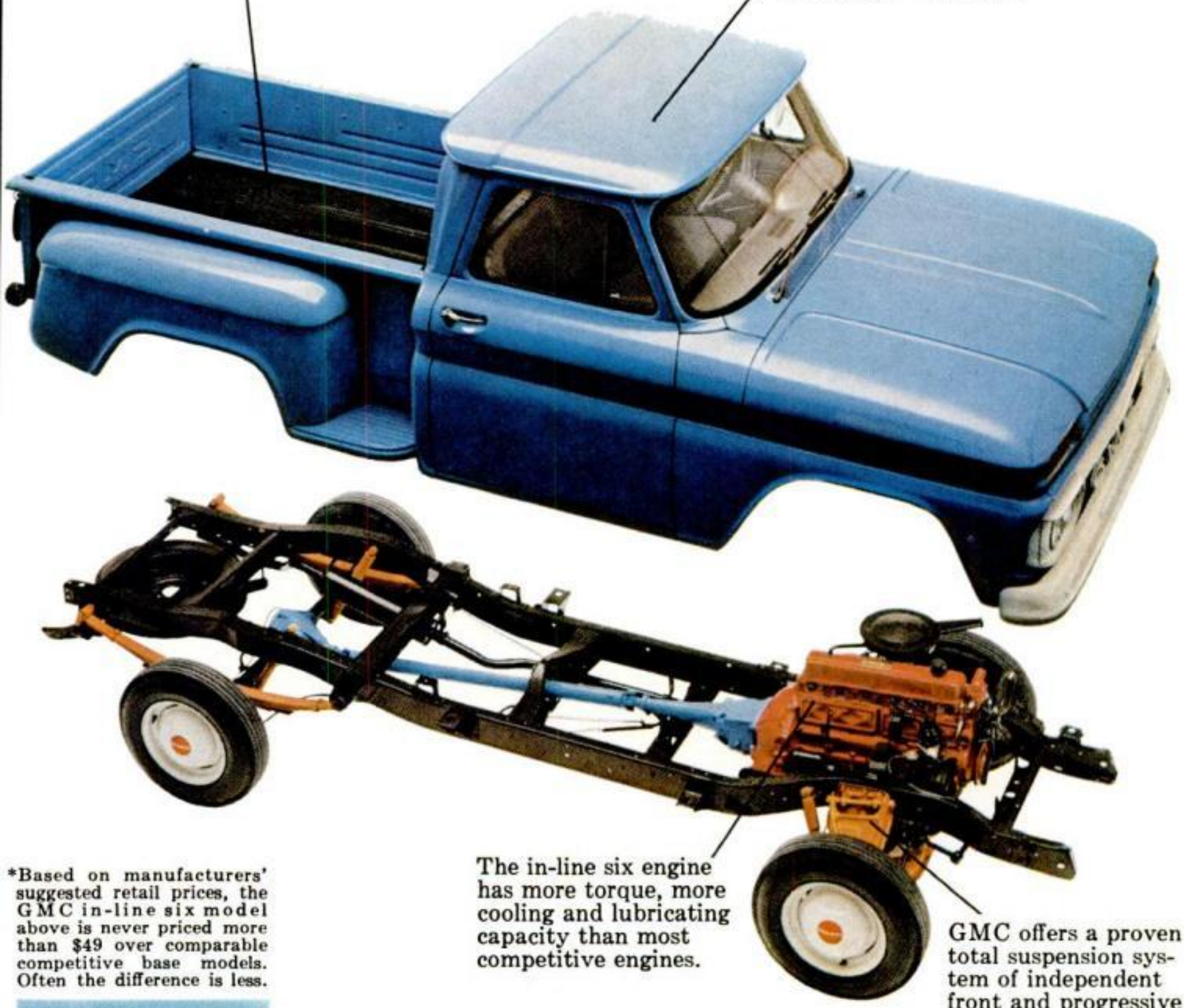

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